CHEMICAL STOCKPILE DISPOSAL PROGRAM

CDTF

CHEMICAL DEMILITARIZATION TRAINING FACILITY

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TRAINEE GUIDE
(T005)

PLANT SYSTEMS DESCRIPTION (PSD)

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Prepared for:

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AND
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LIST OF EFFECTIVE PAGES

Page No.	Change in Effect
Title Page	Rev. D/Change 7
ii thru viii	Rev. D/Change 7
Page 1 thru 227	Rev. D/Change 7
Appendix A A-1 thru A-4	Rev. D/Change 7

CHANGE RECORD

NUMBER AND DESCRIPTION OF CHANGE	ENTERED BY	DATE
Change 1: Updated Wet Pollution Abatement System section to include PAS Filter System. Added drawings for the Residue Handling Area.	RVR	May 1999
Change 2: Added acronym list to the back. Added the information concerning the Gimbal Cam Socket.	David Milton	May 2001
Change 3: Added PBCDF site buildings and descriptions and PBCDF Site Specific Drawing. Removed Dunnage material and HCL material, updated graphics, and corrected grammatical errors. Also numbered the Table of Contents.	Christen Riley	March 2002
Change 4: Added Dry Chemical System for Toxic Cubicle back into the material.	Christen Riley	May 2002
Change 5: Made typographical/clarification changes and updated graphics.	Christen Riley	August 2002
Change 6: Reworded the On-Site Container Objective	Christen Riley	September 2002
Change 7: Corrected and Added information on the Mine Machine Page 136, Removed the last sentence from Orientation Station Page 138, and Updated Front Matter.	David Milton	January 2003

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SAFETY/HAZARD AWARENESS NOTICE

Plant Systems Description is designed to make trainees aware of physical, functional, and interface operations of the Chemical Agent Disposal Facility. There are no hazards associated with the presentation of this course.

Report all hazards. If at any time you detect a hazard, it is your responsibility to report the hazard to ensure that it is corrected. If at any time you detect a "new" or "suspected new" hazard, particularly due to equipment installation, modification, or repair, it is your responsibility to report it, through your foreman or manager. This will ensure that this hazard will be investigated, publicized, or corrected, as required.

UNIT 1: INTRODUCTION

OUTLINE SHEET 1-1-1
CHEMICAL STOCKPILE DISPOSAL PROGRAM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 1-1-1 "Chemical Stockpile Disposal Program".

B. LESSON OBJECTIVES

1. **DESCRIBE** the Chemical Stockpile Disposal Program.

    1.1 **STATE** the purpose of the Chemical Stockpile Disposal Program.

    1.2 **STATE** the purpose of each Chemical Agent Disposal Facility.

2. **DESCRIBE** the chemical munitions involved in the Chemical Stockpile Disposal Program.

    2.1 **IDENTIFY** three types of explosive chemical munitions in the chemical stockpile.

    2.2 **LIST** the three types of bulk items in the chemical stockpile.

C. OUTLINE OF LESSON CONTENT

1. History

    a. Chemical Agent Disposal Facility (CDF)

2. Agent and Munition Information

INFORMATION SHEET 1-1-1
CHEMICAL STOCKPILE DISPOSAL PROGRAM

A. INTRODUCTION

This information sheet provides a history of the Chemical Stockpile Disposal Program. Included is a listing of where the chemical weapons are stored. A table is provided to show how many of each type of munition is stored at each facility.

B. REFERENCES

1. Chemical Stockpile Disposal Program, General Information, (PMCD APG, MD)

2. The United States Chemical Stockpile Disposal Program (leaflet), PMCD, Office of the Chief of Public Affairs, APG, MD

C. INFORMATION

1. HISTORY

For more than half a century, the United States has maintained a stockpile of chemical agents and munitions for possible use in wartime. The United States maintains its stockpile principally to deter other countries from using such weapons against U.S. forces.

Since signing the Geneva Protocol condemning chemical weapons, the United States has sought to eliminate those in its own arsenal in a safe and environmentally responsible way. Until 1969, obsolete or unserviceable chemical agents and munitions were routinely disposed of by open-pit burning, land burial, or ocean dumping. These disposal methods were used extensively dating back to World War I without any casualties or adverse public reactions.

The Army then launched an extensive program that involved the development of new disposal concepts and process technology, new rigid worker safety and health standards, and advanced monitoring equipment to document compliance with new health and safety standards and environmental regulations. Therefore, the Army established the Chemical Stockpile Disposal Program (CSDP).

INFORMATION SHEET 1-1-1 (Continued)
CHEMICAL STOCKPILE DISPOSAL PROGRAM

The purpose of the Chemical Stockpile Disposal Program is to dispose of the stockpiled chemical agents and munitions, thereby eliminating the risk to the public from their continued deterioration and storage. Under the Chemical Stockpile Disposal Program, the U.S. Army will demilitarize (destroy) the stockpile of aging chemical agents and munitions in the continental United States. Congress has directed the Army to accomplish the demilitarization in such a manner as to provide:

- Maximum protection of the environment, of the general public, and of the personnel who will be involved in the destruction process
- Adequate and safe facilities designed solely for the destruction of the aging chemical stockpile
- Cleanup, dismantling, and disposal of the facilities when the disposal process is complete

CHEMICAL AGENT DISPOSAL FACILITY (CDF)

After careful review of the options available for destroying the chemical stockpile, the Army decided that the safest way to dispose of the chemical weapons was by on-site incineration. This decision, which was supported by several independent studies, would eliminate the risk of transporting the stockpile to a centralized facility and confine the disposal process to the sites where the stockpiles are stored. Consequently, plans were initiated to establish a Chemical Agent Disposal Facility at each of the eight stockpile storage sites. The purpose of each facility is to demilitarize the chemical stockpile stored on site in a safe and environmentally acceptable manner.

The locations of the eight sites in the continental U.S. are shown in Figure 1-1. In addition, the Army stores chemical munitions on Johnston Atoll in the Pacific Ocean. Figure 1-2 illustrates the distribution of the chemical stockpile.

INFORMATION SHEET 1-1-1 (Continued)
CHEMICAL STOCKPILE DISPOSAL PROGRAM

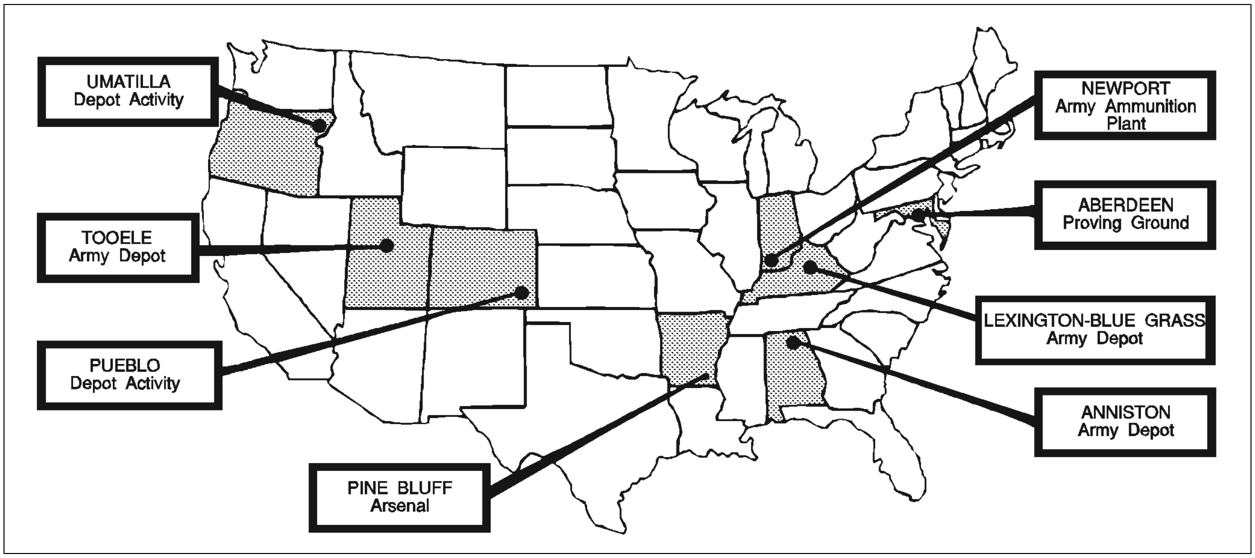

Figure 1-1: Map of Continental U.S. Storage Sites

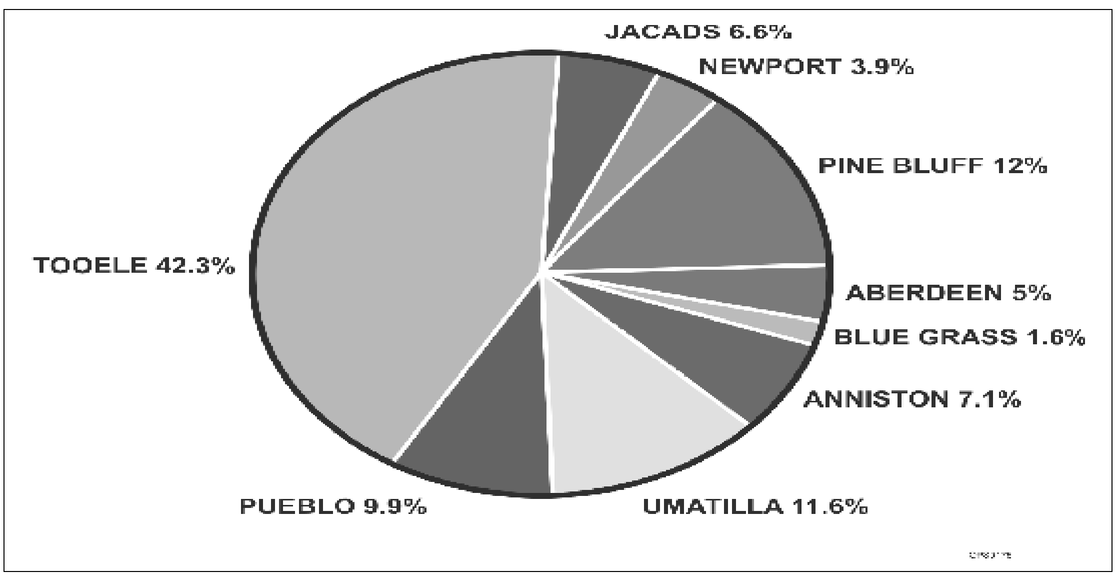

Figure 1-2: Stockpile Distribution by Agent Tonnage

INFORMATION SHEET 1-1-1 (Continued)
CHEMICAL STOCKPILE DISPOSAL PROGRAM

2. AGENT AND MUNITION INFORMATION

The two basic types of toxic chemicals stored in the United States are nerve agents and blister agents. These agents are stored in a variety of munitions and containers. None of the agents or munitions currently in storage have been manufactured since 1968. Some munitions are still in good condition, while others are in various stages of deterioration. All items that have been verified as leaking have either been repaired and decontaminated, or containerized and placed in isolated storage.

There are three types of explosive chemical munitions in the chemical stockpile:

- Projectiles/Mortars
- M55 Rockets
- M23 Land Mines

Along with the energetic munitions, there are also bulk containers which include:

- Bombs
- Ton Containers
- Spray Tanks

The bombs do not contain the fuzes, bursters, or any explosive components. Essentially, these containers are punched and drained of the chemical agents.

The following Tables give a listing of the type of munitions/containers stored at each stockpile location as of 1 December 1996.

INFORMATION SHEET 1-1-1 (Continued)
CHEMICAL STOCKPILE DISPOSAL PROGRAM

Table 1-1: PROJECTILE/MORTAR CHEMICAL STOCKPILE

MUNITION	Agent	ANCDF	BGCDF	JACADS	PUCDF	TOCDF	UMCDF
4.2-in Mortar, M2	HT	183,552	-	-	20,384	62,590	-
4.2-in Mortar, M2A1	HD	75,360	-	43,660	76,722	976	-
105mm Projectile, M60	HD	23,064	-	46	383,418	-	-
105mm Projectile, M360	GB	74,040	-	49,360	-	798,703	-
155mm Projectile, M104	H	-	-	-	-	10,281	-
155mm Projectile, M104	HD	-	-	109	33,062	-	-
155mm Projectile, M110	H	-	15,492	-	-	44,382	-
155mm Projectile, M110	HD	17,643	-	5,670	266,492	-	-
155mm Projectile, M121A1	GB	3,600	-	57,356	-	67,685	47,406
155mm Projectile, M121A1	VX	139,581	12,816	42,682	-	53,216	32,313
155mm Projectile, M122	GB	6,000	-	-	-	21,456	-
8-in Projectile, M426	GB	-	3,977	13,020	-	-	14,246
8-in Projectile, M426	VX	16,026	-	14,519	-	1	3,752

INFORMATION SHEET 1-1-1 (Continued)
CHEMICAL STOCKPILE DISPOSAL PROGRAM

Table 1-2: ROCKETS/MINES CHEMICAL STOCKPILE

MUNITION	Agent	ANCDF	BGCDF	JACADS	PBCDF	TOCDF	UMCDF
M55 Rocket	GB	42,738	51,716	-	90,231	20,887	91,735
M55 Rocket	VX	35,636	17,733	-	19,582	3,966	14,513
M56 Rocket Warhead	GB	24	24	-	178	1,056	67
M56 Rocket Warhead	VX	26	6	-	26	3,560	6
M23 Land Mine	VX	44,131	-	13,302	9,378	22,690	11,685

Table 1-3: BULK CHEMICAL STOCKPILE

MUNITION	Agent	ABCDF	ANCDF	JACADS	NECDF	PBCDF	TOCDF	UMCDF
Ton Container	HD	1,818	108	68	-	3,698	6,398	2,635
Ton Container	VX	-	-	66	1,690	-	640	-
Ton Container	GB	-	-	66	-	-	5,709	-
Spray Tanks	VX	-	-	-	-	-	862	156
MC-1 Bomb (750 lb)	GB	-	-	3,047	-	-	4,463	2,418
MK-94 Bomb (500 lb)	GB	-	-	2,490	-	-	-	27
MK-116 Bomb (Weteye)	GB	-	-	-	-	-	888	-

UNIT 2: CHEMICAL AGENT DISPOSAL FACILITY OVERVIEW

OUTLINE SHEET 2-1-1
SITE LAYOUT

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 2-1-1 “Site Layout”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the layout of a Chemical Agent Disposal Facility.

   1.1 **IDENTIFY** the purpose of each of the functional buildings at a Chemical Agent Disposal Facility.

   - Entry Control Facility
   - Process and Utility Building
   - Container Handling Building
   - Munitions Demilitarization Building
   - Personnel and Maintenance Building (TOCDF, UMCDF, & ANCDF only)
   - Process Support Building (TOCDF, UMCDF, & ANCDF only)
   - Monitor Support Building (TOCDF only)
   - Personnel Support Complex (PBCDF only)
   - Medical and Maintenance Building (PBCDF only)
   - Laboratory (ANCDF, UMCDF, & PBCDF only)

C. OUTLINE OF LESSON CONTENT

1. Site Overview

   a. Functional Buildings

   (1) Process Support Building (PSB)

   (2) Personnel Support Complex (PSC)

   (3) Entry Control Facility (ECF)

   (4) Personnel and Maintenance Building (PMB)

   (5) Medical and Maintenance Building (MMB)

   (6) Process and Utility Building (PUB)

   (7) Monitor Support Building (MSB)

   (8) Laboratory (LAB)

   (9) Container Handling Building (CHB)

   (10) Munitions Demilitarization Building (MDB)

INFORMATION SHEET 2-1-1 (Continued)
SITE LAYOUT

A. INTRODUCTION

This information sheet shows and describes the layout of a typical chemical agent disposal facility.

B. REFERENCES

1. Tooele Chemical Agent Disposal Facility Quantitative Risk Assessment

2. System Hazard Analysis for Container Handling Building

3. Container Handling Building Project Development Brochure Tooele Army Depot

4. Facility Design Analysis

C. INFORMATION

1. SITE OVERVIEW

The chemical agent disposal site consists of several major structures and process areas, each of which is designed to provide a specific support capability to the demilitarization process. Figure 2-1 shows the general layout of a Chemical Agent Disposal Facility. All sites contain the same basic areas, but the arrangement may differ slightly.

INFORMATION SHEET 2-1-1 (Continued)
SITE LAYOUT

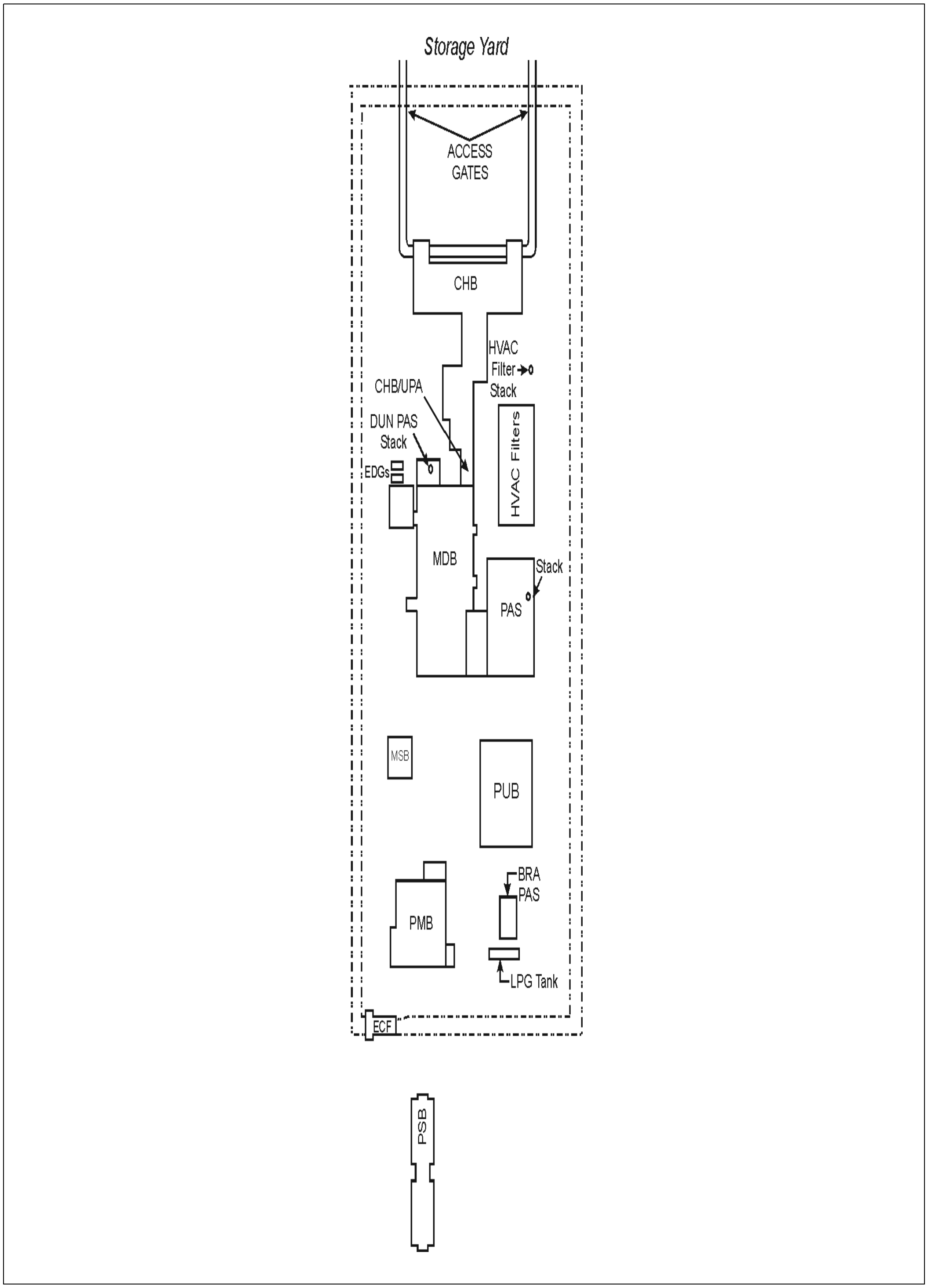

Figure 2-1: Chemical Agent Disposal Facility Layout
(ANCDF, TOCDF,and UMCDF only)

INFORMATION SHEET 2-1-1 (Continued)
SITE LAYOUT

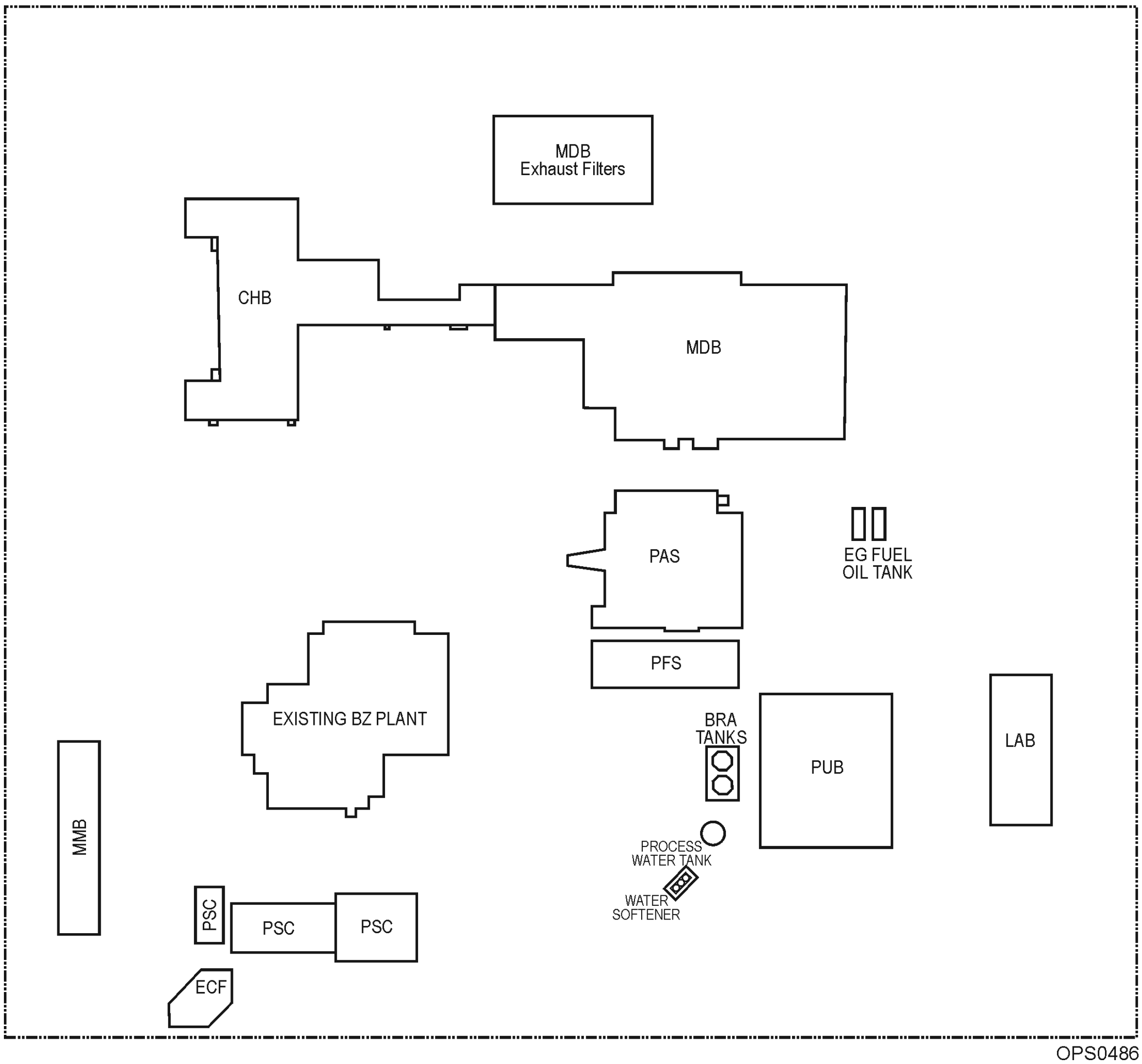

Figure 2-2: Chemical Agent Disposal Facility Layout (PBCDF only)

INFORMATION SHEET 2-1-1 (Continued)
SITE LAYOUT

FUNCTIONAL BUILDINGS

Process Support Building (PSB)

The Process Support Building houses the administrative and support staff.

Personnel Support Complex (PSC)

The Personnel Support Complex houses offices, DPE bottle filling station, DSA support area and clothing issue, and change rooms.

Entry Control Facility (ECF)

The Entry Control Facility houses security personnel who screen, monitor, and control the personnel and vehicular traffic to and from the complex.

Personnel and Maintenance Building (PMB)

The Personnel and Maintenance Building houses the following functions for the disposal site staff within the secure fence:

- Demilitarization Protective Ensemble (DPE) support area
- Repair area and stores
- Medical area
- Radio room
- Lunchroom
- Locker room and showers
- Mechanical/electrical support equipment areas

Medical and Maintenance Building (MMB)

The Medical and Maintenance Building houses plant maintenance and the medical department.

INFORMATION SHEET 2-1-1 (Continued)
SITE LAYOUT

Process and Utility Building (PUB)

The Process and Utility Building contains several utility systems that support process operations. These systems or areas include:

- Brine Reduction Area (BRA)
- Bulk Chemical Storage
- Boiler Room
- Forklift Battery Charging Area
- Residue Handling Area (RHA)
- LPG Dilution Air Compressor
- Central Decon Supply Tank

Monitor Support Building (MSB)

The Monitoring Support Building (also known as the Lab) houses the onsite maintenance facilities for the agent monitoring equipment.

Container Handling Building (CHB)

The Container Handling Building is designed to provide safe, temporary storage for chemical munitions prior to unpacking and transporting them into the Munitions Demilitarization Building (MDB). The Container Handling Building also supplies heat to thaw munitions containing mustard agents which can freeze at temperatures below 58° F.

Munitions Demilitarization Building (MDB)

The Munitions Demilitarization Building houses the basic process equipment and control systems necessary to demilitarize the chemical munitions. Figures 2-2 and 2-3 display the floor layouts of the MDB. The MDB includes the following four major functional operations:

- **Munitions Processing**: To prepare munitions and bulk items for incineration and decontamination.

- **Incineration**: To incinerate and process exhaust gases before release.

- **Support Areas**: To provide HVAC, electrical, and other miscellaneous support equipment rooms.

- **Process Control, Personnel, and Maintenance Areas**: To provide operation, maintenance, and personnel support.

INFORMATION SHEET 2-1-1 (Continued)
SITE LAYOUT

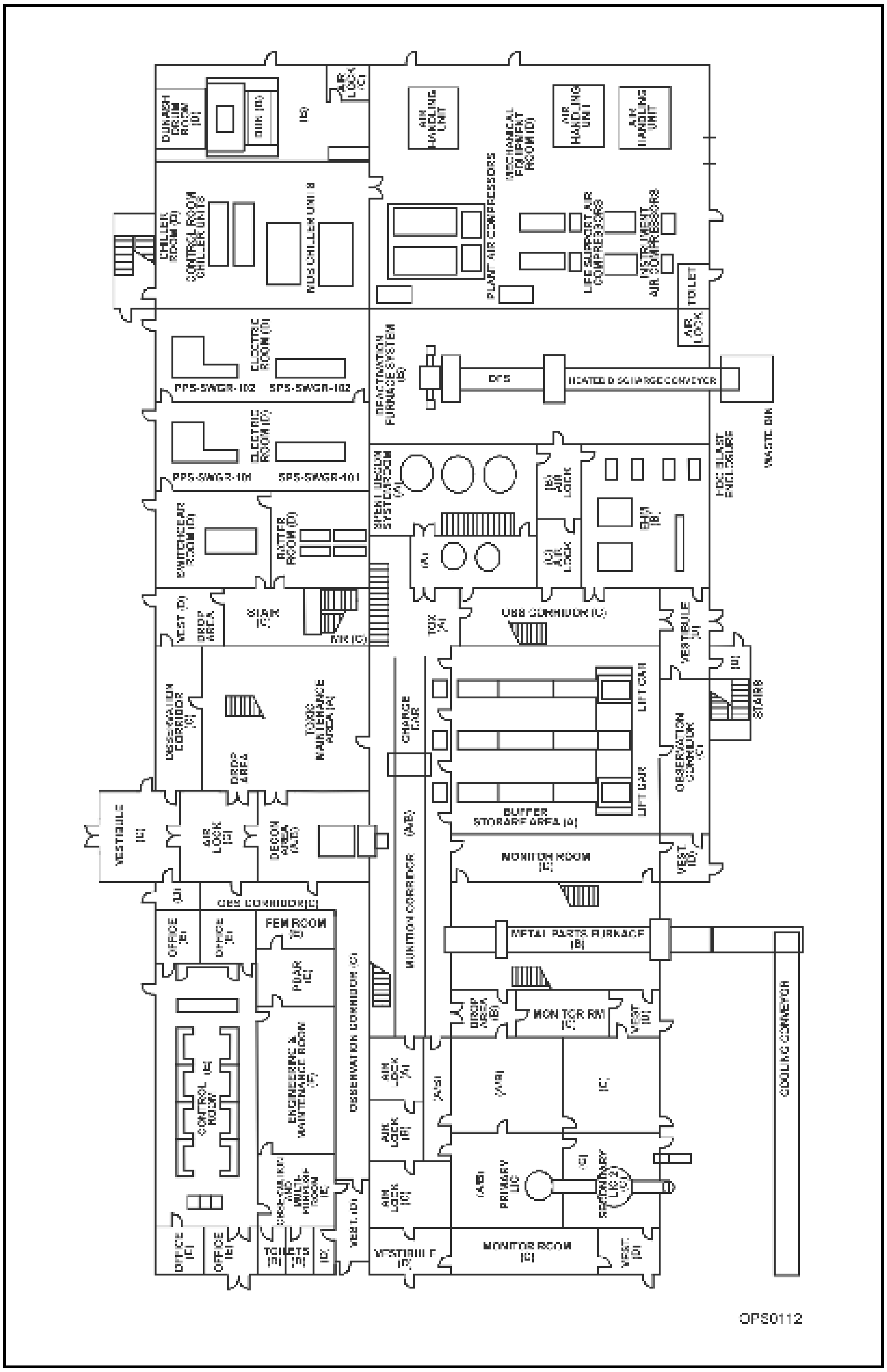

Figure 2-3: First Floor Plan of MDB

INFORMATION SHEET 2-1-1 (Continued)
SITE LAYOUT

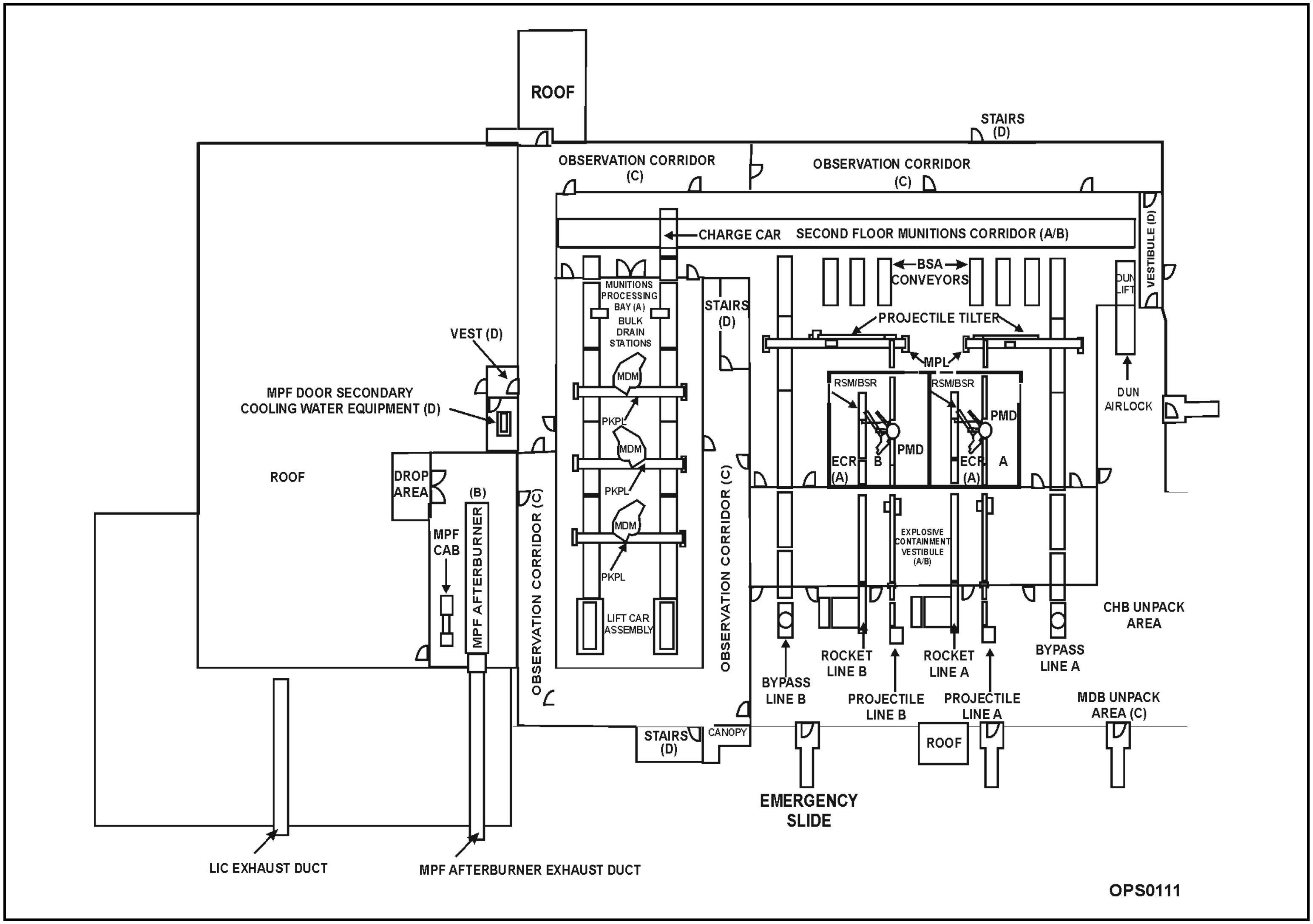

Figure 2-4: Second Floor Plan of MDB

OUTLINE SHEET 2-2-1
MUNITION STORAGE & HANDLING

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 2-2-1 "Munition Storage & Handling".

B. LESSON OBJECTIVES

1. **DESCRIBE** the storage and handling of chemical weapons at a Chemical Agent Disposal Facility.

    1.1 **IDENTIFY** where munitions are stored.

    1.2 **IDENTIFY** the purpose of the On-Site Container (ONC).

    1.3 **DESCRIBE** how On-Site Containers are monitored for leaking munitions prior to opening.

C. OUTLINE OF LESSON CONTENT

1. Munition Storage

2. On-Site Containers

3. Munition Handling in the Container Handling Building/Unpack Area

    a. Handling of Leaking Munitions

INFORMATION SHEET 2-2-1
MUNITION STORAGE & HANDLING

A. INTRODUCTION

This information sheet describes where chemical weapons are stored at a Chemical Agent Disposal Facility. Also discussed is the method for transporting the weapons from the storage locations to the Container Handling Building and Unpack Area for preparation for processing.

B. REFERENCES

1. Tooele Chemical Agent Disposal Facility Quantitative Risk Assessment

2. Anniston Chemical Agent Disposal Facility Phase 1 Quantitative Risk Assessment

3. The U.S. Chemical Weapons Destruction Program: Views, Analysis, and Recommendation: The Henry L. Stimson Center.

C. INFORMATION

1. MUNITION STORAGE

The destruction process begins with the transportation of the chemical weapons from either storage sheds or earth-covered protective igloos to the Chemical Agent Disposal Facility. An igloo is an arched-ceiling storage building covered by several feet of earth. The igloos are constructed of reinforced concrete and have steel doors. The storage igloos also have a lightning protection system. There is passive ventilation in the form of both louvered vents in the front concrete face or in the door, as well as a single ventilation stack penetrating the earthen cover at the rear of the igloos. Figure 2-4 shows a illustration of a igloo.

INFORMATION SHEET 2-2-1 (Continued)
MUNITION STORAGE & HANDLING

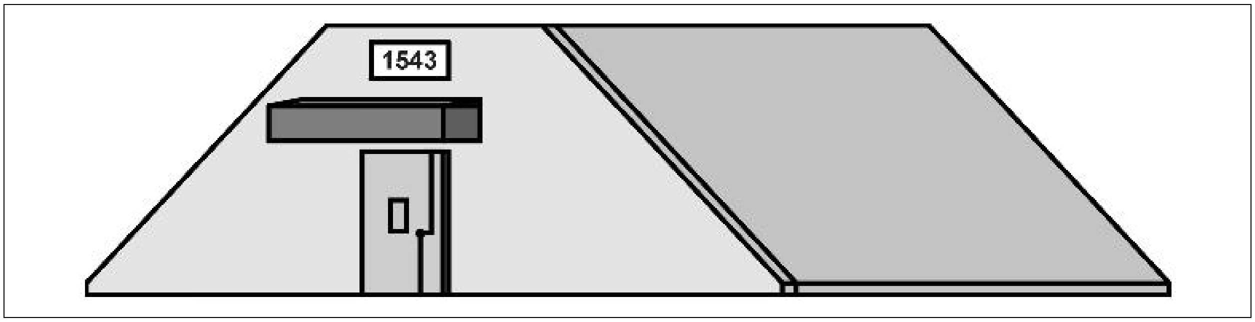

Figure 2-5: Ammunition Storage Igloo

2. ON-SITE CONTAINERS

The purpose of the On-Site Containers are to safely transport munitions from the storage igloo to the Unpack Area (UPA). Forklifts are used to remove munitions from the storage igloos and load them into an On-Site Container (ONC). The ONCs are double-walled, cylindrical steel containers weighing approximately 10 tons when empty. They are designed to resist impact, puncture, and fire. ONCs are transported on a trailer from the storage igloos to the Container Handling Building. Table 2-1 shows the capacity of an ONC for different munitions. Figure 2-5 shows an On-Site Container.

Table 2-1: ONC Loading

Munition	ONC Capacity
Rockets	2 pallets (each pallet contains 15 rockets)
Mines	1 pallet (a pallet contains 12 drums, each drum contains 3 mines)
155mm Projectiles	6 pallets (each pallet contains 8 projectiles)
105mm Projectiles	4 pallets (each pallet contains 24 projectiles)
8-inch Projectiles	6 pallets (each pallet contains 6 projectiles)
4.2-inch Mortars	4 pallets (each pallet contains 24 mortars)
Ton Containers	2 per ONC
MC-1 Bombs	2 pallets (each pallet contains 2 bombs)
MK-94 Bombs	1 pallet (a pallet contains 5 bombs)

Note: Spray Tanks and MK-116 Weteye Bombs are transported in their own shipping containers and are not received at the CHB in an ONC.

INFORMATION SHEET 2-2-1 (Continued)
MUNITION STORAGE & HANDLING

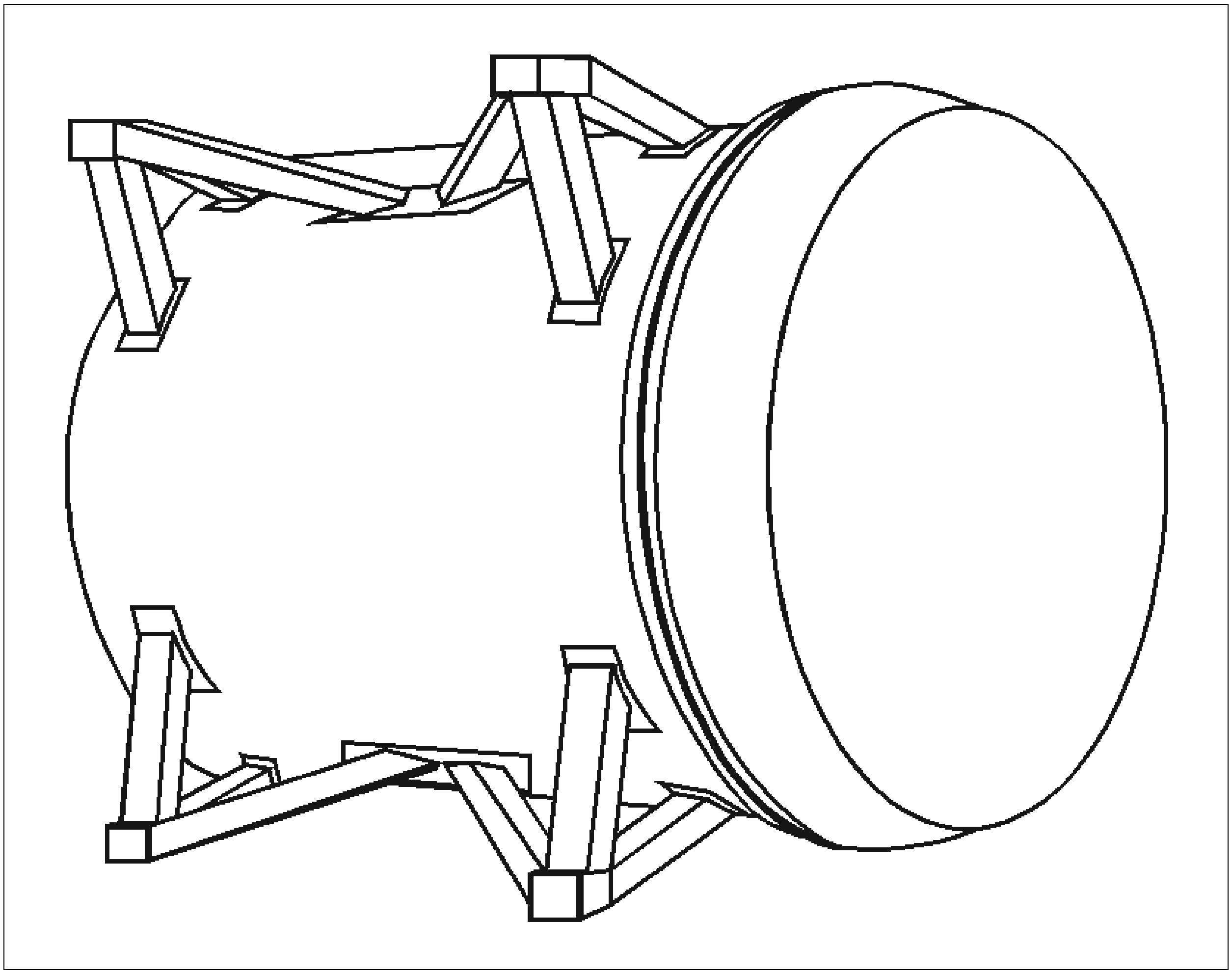

Figure 2-6: On-Site Container

INFORMATION SHEET 2-2-1 (Continued)
MUNITION STORAGE & HANDLING

3. MUNITION HANDLING IN THE CONTAINER HANDLING BUILDING/ UNPACK AREA

Once the munitions are loaded into the ONC, the truck proceeds to one of the Container Handling Building (CHB) unloading docks (Figure 2-6). At the CHB unloading docks, overhead cranes are used to lift the ONCs from the trucks. The ONCs are then placed on a floor-level conveyor system where they are stored and later conveyed one at a time through the CHB to an elevator that transports them up to the second floor Unpack Area (UPA). The UPA has two sections: the Container Handling Building Unpack Area (CHB UPA) and the Munitions Demilitarization Unpack Area (MDB UPA). In the CHB UPA (Figure 2-7), the ONCs are opened and the munitions removed. Before the ONCs are opened, they are monitored with an Automatic Continuous Air Monitoring System (ACAMS) through a monitoring port to ensure that no leakage has occurred during transport. A combination of overhead crane and forklift movements are used to transport the munitions to the MDB UPA where they are placed on the conveyors that move them into the automated disposal process. Empty ONCs are taken down another elevator and returned to the CHB loading docks.

INFORMATION SHEET 2-2-1 (Continued)
MUNITION STORAGE & HANDLING

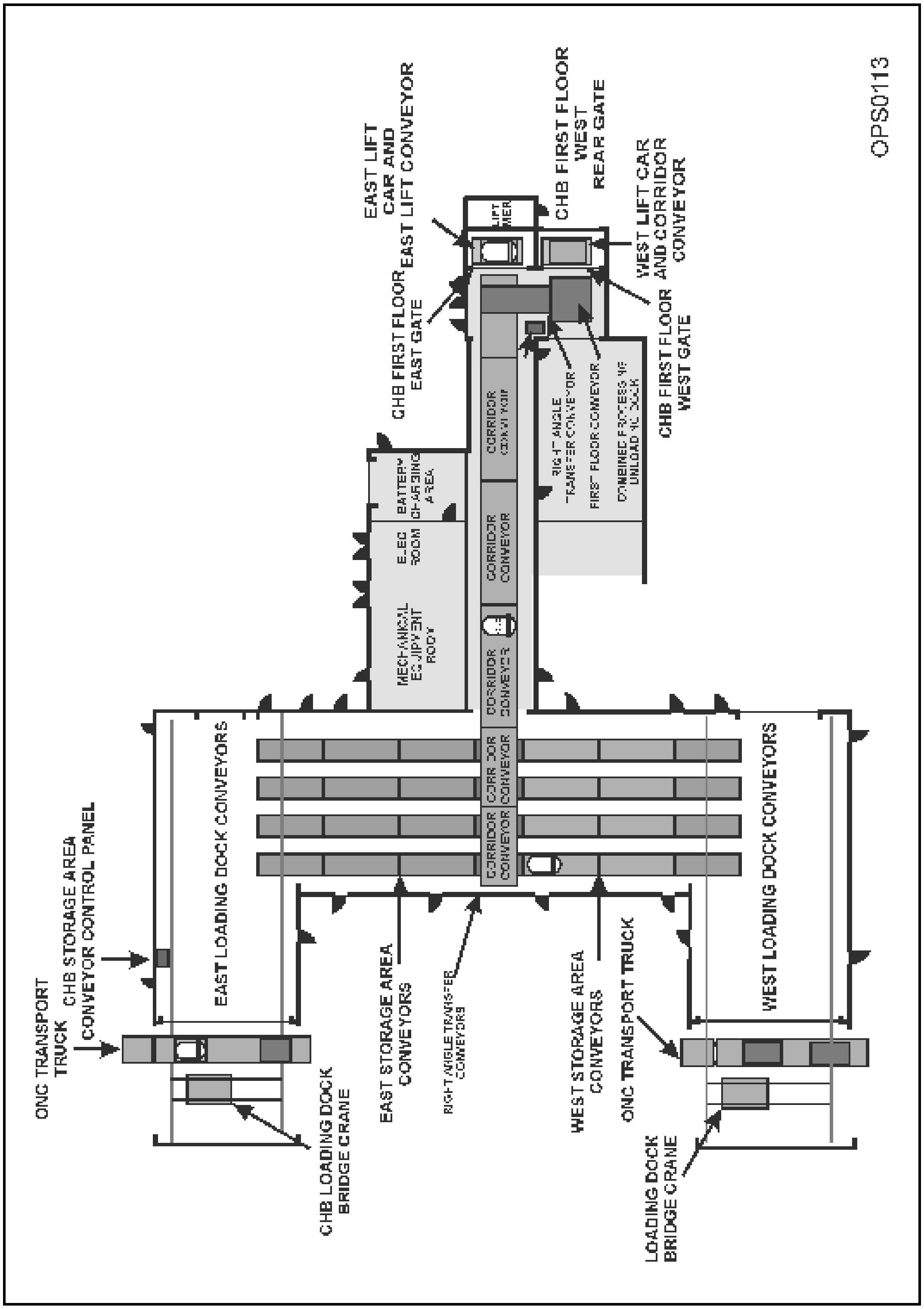

Figure 2-7: Container Handling Building

INFORMATION SHEET 2-2-1 (Continued)
MUNITION STORAGE & HANDLING

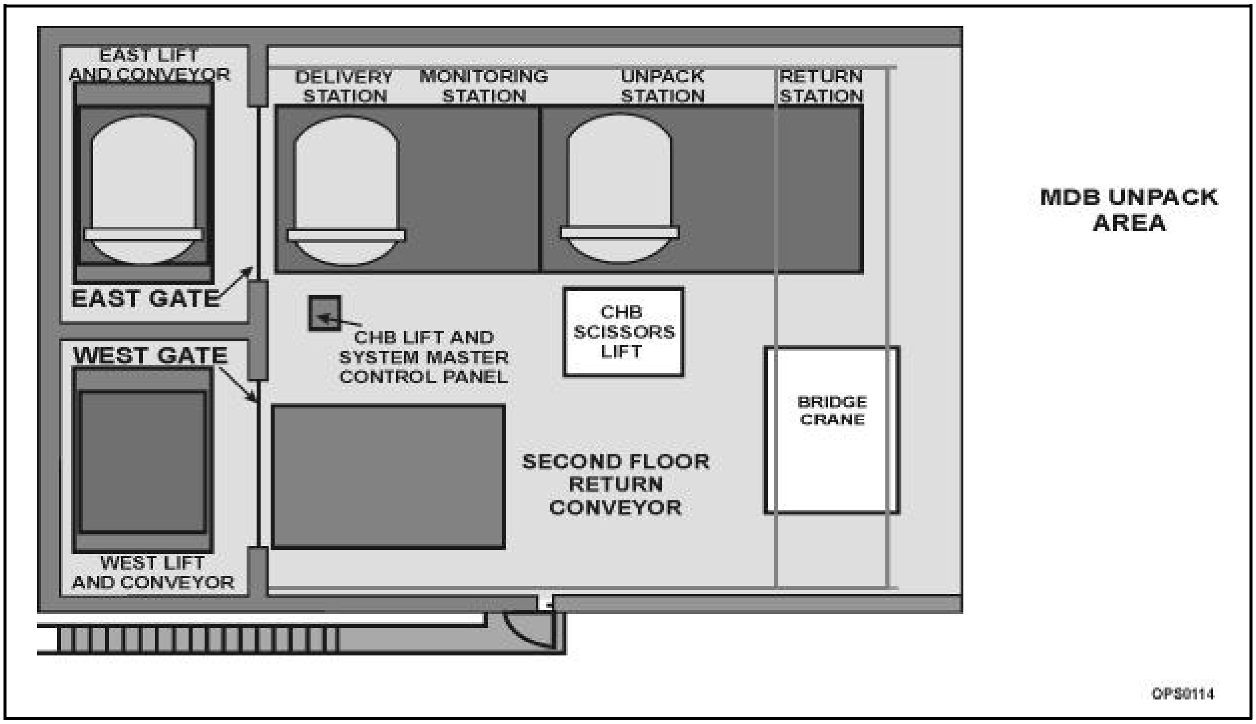

Figure 2-8: CHB/UPA

INFORMATION SHEET 2-2-1 (Continued)
MUNITION STORAGE & HANDLING

HANDLING OF LEAKING MUNITIONS

When agent is detected within a stockpile structure (igloo), the leaking munition is identified, removed from its pallet configuration, decontaminated and placed in an overpack. Overpacked munitions are then transferred to a separate storage igloo where the overpack containers are palletized for continued storage.

Pallets of overpacked munitions are delivered in ONCs to the UPA similar to nonleaking munitions. Because of the overpack, the leakers cannot be loaded onto their processing conveyors like nonleaking munitions. The entire pallet is loaded onto a bypass line turntable, conveyed through an airlock into the explosive containment vestibule (ECV), and unpacked by workers in demilitarization protective ensemble (DPE).

Leakers can also be detected after delivery of a loaded ONC to the CHB UPA where the ONC is monitored before being unloaded. If an ONC is found to contain a leaking munition, the ONC is returned to the first floor CHB lift area and taken to the toxic maintenance area (TMA). The pallets are unloaded from the ONC by personnel in DPE suits in the TMA. The pallet is then conveyed out of the TMA and to the ECV where workers in DPE suits load the munitions for processing. Figure 2-8 show a basic overview of the entire demilitarization process.

INFORMATION SHEET 2-2-1 (Continued)
MUNITION STORAGE & HANDLING

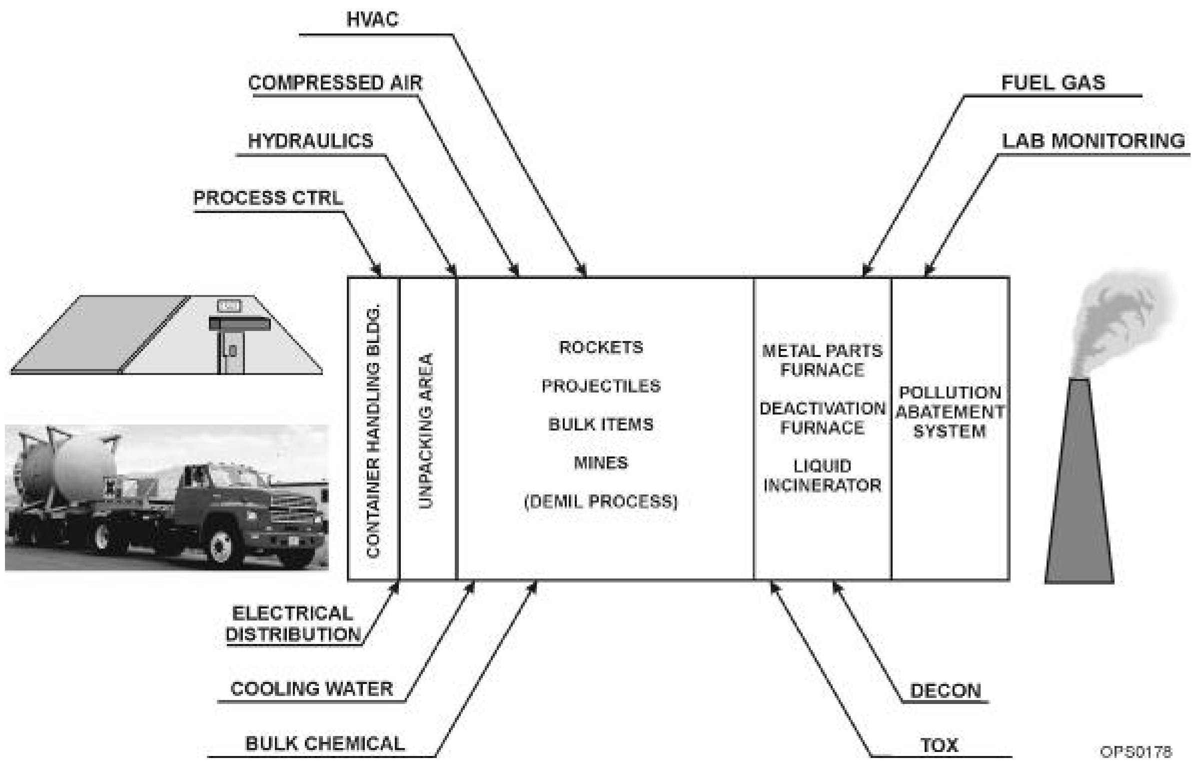

Figure 2-9: Munition Process Overview

UNIT 3: UTILITY SYSTEMS

OUTLINE SHEET 3-1-1
PROCESS CONTROL EQUIPMENT

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-1-1 “Process Control Equipment”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Process Control Equipment.

   1.1 **IDENTIFY** the purpose of the Process Control Equipment

   1.2 **IDENTIFY** the function of the following major components associated with Process Control Equipment.
   - Programmable Logic Controller (PLC)
   - Advisor Personal Computer (PC)
   - Operator Console
   - Status Panels
   - Demilitarization Protective Ensemble (DPE)Team Console
   - Process Data Acquisition Recording (PDAR)
   - Printers/Videocopiers

C. OUTLINE OF LESSON CONTENT

1. Process Control Equipment Overview

   a. Purpose

   b. System Description

      (1) Programmable Logic Controller

      (2) Advisor Personal Computer

      (3) Operator Console

      (4) Status Panels

      (5) Demilitarization Protective Ensemble (DPE)Team Console

      (6) Process Data Acquisition Recording System

      (7) Printers/Videocopiers

INFORMATION SHEET 3-1-1
PROCESS CONTROL EQUIPMENT

A. INTRODUCTION

This information sheet explains the purpose of the Process Control Equipment, including a basic description of the components used in monitoring the facility.

B. REFERENCES

1. Tooele General Arrangement Drawing: TE-1-E-505.

C. INFORMATION

1. PROCESS CONTROL EQUIPMENT OVERVIEW

PURPOSE

The purpose of process control equipment is to provide operations and maintenance personnel with a centralized means to monitor and control the demilitarization plant under all conditions. Figure 3-1 illustrates the Control Room layout with the Process Control equipment.

INFORMATION SHEET 3-1-1 (Continued)
PROCESS CONTROL EQUIPMENT

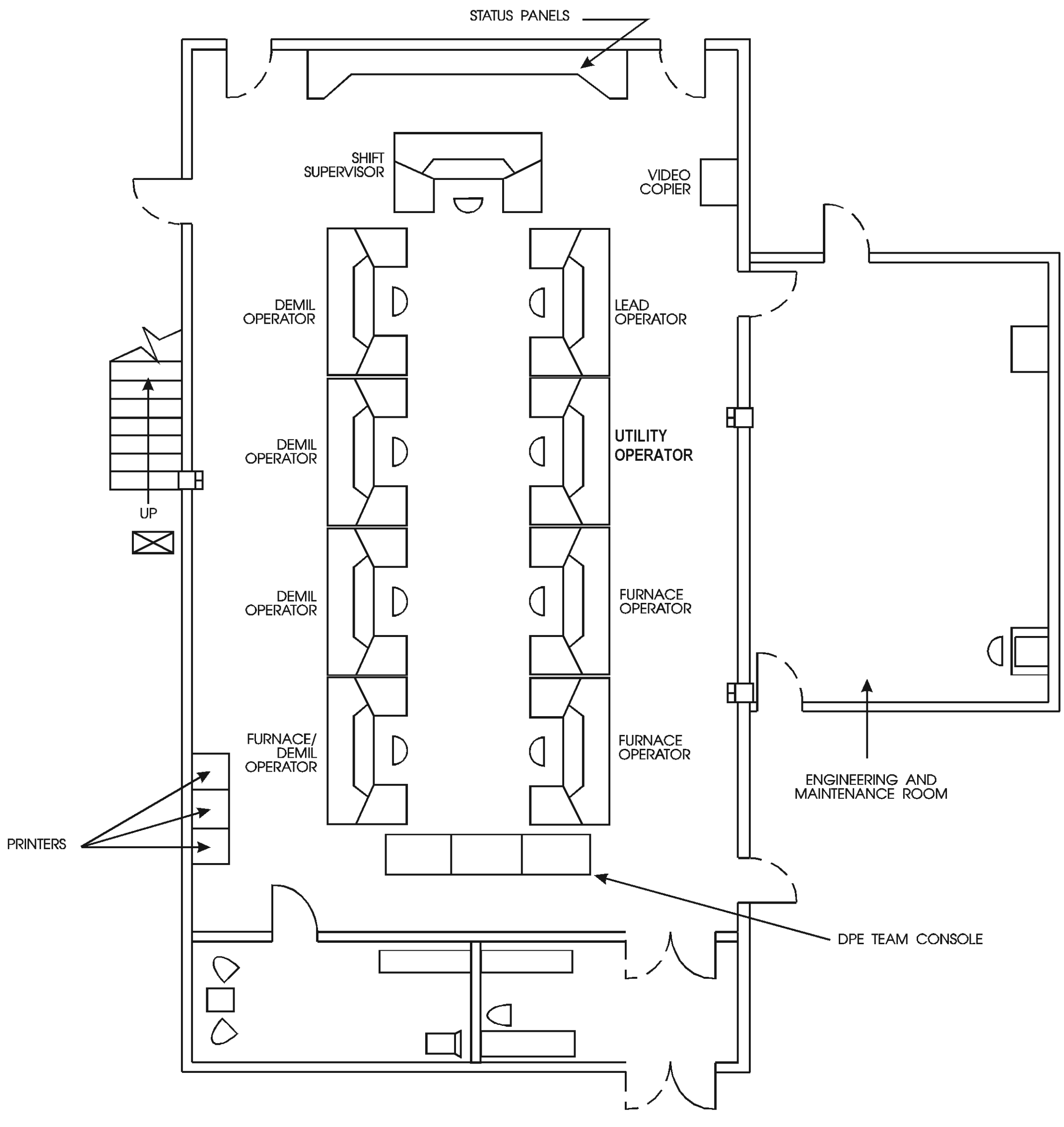

Figure 3-1: Control Room Layout

INFORMATION SHEET 3-1-1 (Continued)
PROCESS CONTROL EQUIPMENT

SYSTEM DESCRIPTION

In order to accomplish all the necessary tasks required for monitoring and maintaining the plant in a safe manner, a wide variety of equipment is used. The following paragraphs describe some of the major equipment used in this process.

Programmable Logic Controller

A programmable logic controller (PLC) is a device that performs discrete or continuous control logic in the demil facility. The PLC contains the computer controls that allow control of equipment such as valves, pumps, motors, and other equipment. PLCs control the process operations within the plant through the execution of arithmetic steps programmed in software. Additionally, interlocks provide failsafe operation of the plant processes.

Advisor Personal Computer

Advisor Personal Computer (PC) is a color graphic operator interface that delivers plant process information to the Control Room Operator. This process information includes process data such as temperatures, pressures, flows and alarms. The Advisor PC links the Control Room Operators with process equipment through the PLCs. As plant processes change, the Advisor reads the information from the PLCs and updates the status to the Control Room Operator. Additionally, the Advisor PC provides control over process equipment. The Control Room Operator can send commands, using a custom keyboard with a trackball, through the PLCs to the process equipment providing real time device control.

INFORMATION SHEET 3-1-1 (Continued)
PROCESS CONTROL EQUIPMENT

Operator Console

The Control Room consists of several Operator Consoles. The Operator Console contains the necessary controls and indications to properly monitor and control various demilitarization processes. An Operator Console consists of closed circuit televisions (CCTV) and Advisor PC terminals. The two Advisor PC monitors are operated with one keyboard. The layout of a typical operator console is shown in Figure 3-2.

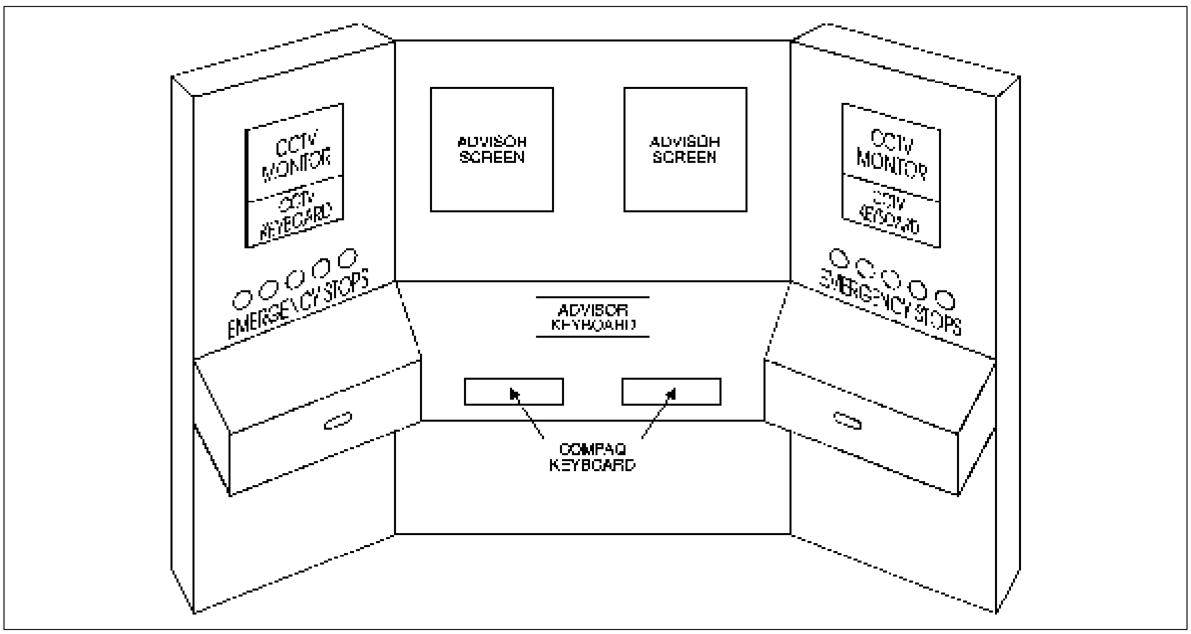

Figure 3-2: Operator Console

INFORMATION SHEET 3-1-1 (Continued)
PROCESS CONTROL EQUIPMENT

Status Panels

The Status Panel located in the Control Room is used to provide additional monitoring of critical systems. The Status Panel consists of three monitors of the Advisor PC, and four sets of CCTVs. These monitors and CCTVs are set up and configured to continuously monitor critical operations which are being performed at the time. Typically the monitors are setup to give indication of parameters such as security, fire indications and containment of the plant. The Advisor PC monitors can display any screen during special evolutions to aid in monitoring. The layout of the status panel is shown in Figure 3-3.

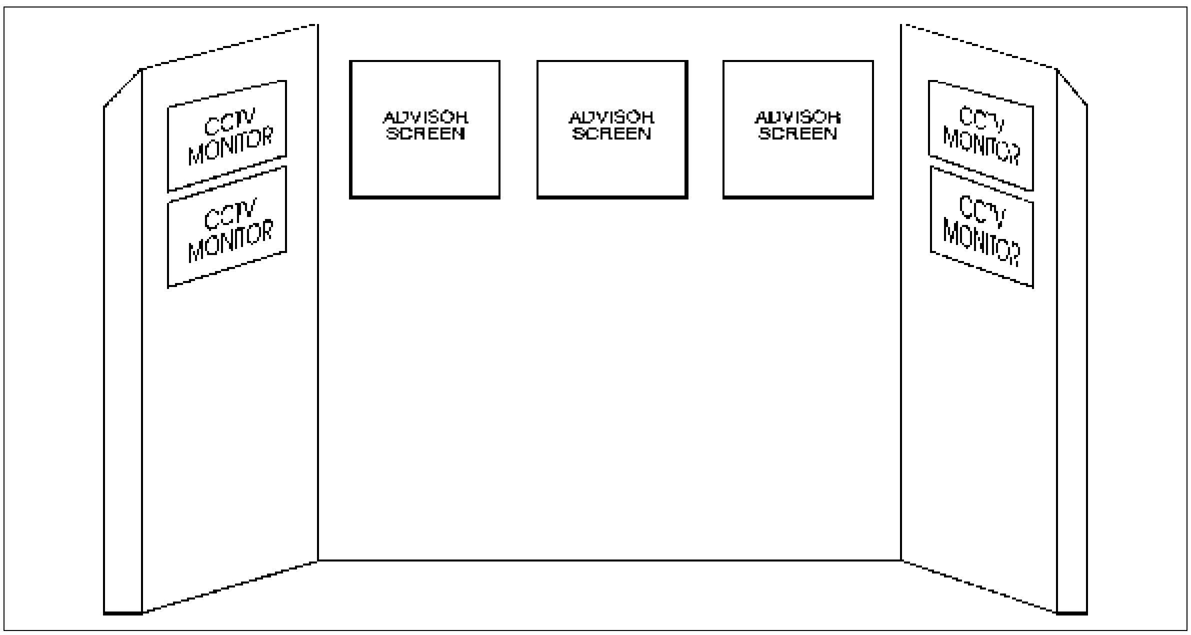

Figure 3-3: Status Panel

INFORMATION SHEET 3-1-1 (Continued)
PROCESS CONTROL EQUIPMENT

Demilitarization Protective Ensemble (DPE) Team Console

The Control Room has three Demilitarization Protective Ensemble (DPE) Team Consoles which are dedicated to the monitoring of personnel during entries into the toxic areas of the Munitions Demilitarization Building (MDB). A DPE Team Console has CCTVs and communications gear for the continuous monitoring of personnel wearing DPE suits in the toxic area of the MDB. Each station also contains a terminal of the Advisor PC which allows the operator to continuously monitor the Life Support Air System, Heating Ventilation & Air Conditioning (HVAC) system, and Automatic Continuous Air Monitoring System (ACAMS).

During normal operations, these consoles are used to monitor and control plant utility systems.

Process Data Acquisition Recording System

The Process Data Acquisition Recording System (PDAR) is a computer based data collection, reporting, and archiving system for monitoring the operation of demilitarization plant operations. The PDAR provides means for automatic production of reports, the generation of special reports, and archival of data.

Printers/Videocopiers

Printers are used in the Control Room for several different functions. The purpose of the alarm printer is to provide a hard copy print of alarms monitored, and commands issued during the operation of the plant.

The videocopier is used to provide hard copy printouts of the Advisor screens. The screens are produced upon request of the operator using the Advisor keyboard.

OUTLINE SHEET 3-2-1
WATER SYSTEMS

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-2-1 "Water Systems".

B. LESSON OBJECTIVES

1. **DESCRIBE** the Water Treatment System.

    1.1 **IDENTIFY** the purpose of the Water Treatment System.

    1.2 Given a block diagram of the Water Treatment System, **LABEL** the following major components:

    - Cation Bed
    - Bulk Salt Storage Tank
    - Brine Transfer Pumps
    - Brine Measuring Tank
    - Regeneration Waste Tank

    1.3 **IDENTIFY** the function of the major components of the Water Treatment System.

2. **DESCRIBE** the Process Water System.

    2.1 **IDENTIFY** the purpose of the Process Water System.

    2.2 **IDENTIFY** the function of the following major components of the Process Water System:

    - Process Water Storage Tank
    - Process Water Supply Pumps
    - Recirculation Line

OUTLINE SHEET 3-2-1 (Continued)
WATER SYSTEMS

C. OUTLINE OF LESSON CONTENT

1. Water Treatment System
   a. System Overview
   b. Process Descriptions/Major Components
      (1) Water Softening Process
         (a) Cation Exchanger
      (2) Regeneration Process
         (a) Bulk Salt Storage Tank
         (b) Brine Transfer Pump
         (c) Brine Measuring Tank
         (d) Regeneration Waste Tank
2. Process Water System
   a. System Overview
   b. Process Description/Major Components
      (1) Process Water Storage Tank
      (2) Process Water Supply Pumps
      (3) Recirculation Line
      (4) Process Water Distribution

INFORMATION SHEET 3-2-1
WATER SYSTEMS

A. INTRODUCTION

This sheet describes the water treatment and process water systems. The information included is a system overview of each system as well as discussion of the major components within each system.

B. REFERENCES

1. TOCDF Functional Analysis Workbook

2. ANCDF Functional Analysis Workbook

C. INFORMATION

1. WATER TREATMENT SYSTEM

SYSTEM OVERVIEW

The water treatment system (Figure 3-4) supplies softened water to the process water system. The water that is supplied from off-site usually contains small amounts of calcium ions which makes the water unfit (hard) for use in equipment used at the demil site. The water treatment system removes calcium ions from the water passed through it. If the water is not softened, the calcium ions could foul heat transfer surfaces and process piping.

INFORMATION SHEET 3-2-1 (Continued)
WATER SYSTEMS

PROCESS DESCRIPTIONS/MAJOR COMPONENTS

Water Softening Process

Cation Exchanger - Water from an outside source is passed through one of the two Cation Exchangers. A cation exchanger contains cation exchange resin. The resin provides negative electric charges and are able to attract and hold the cations which are positively charged. At the start of the softening cycle, the cation resin is occupied by sodium ions from brine. The resin has a greater affinity for a hard ion (magnesium or calcium) than for sodium ions, so when hard water passes through the cation exchanger, it releases its hold on the sodium ion and retains the hard ion.

The softened water leaves the cation exchanger and is sent to either the process water system (and potable water system at some sites) for various uses throughout the site.

Regeneration Process

When most of the available cation resin is occupied by calcium or magnesium ions, hard ions will begin to slip through the bed in increasing amounts. The standby cation exchanger is then put on line and the exhausted cation exchanger is placed in regeneration mode. The exhausted cation exchanger is flushed with saturated brine and the brine flushes away the hard ions and regenerates the resin.

Bulk Salt Storage Tank - Water is combined with salt for use in the softener regeneration cycle. The bulk salt storage tank is a two-sided, cross-connected underground tank. Bulk salt (NaCl, sodium chloride) deliveries of approximately 25 tons are received on one side, and brine solution maintained in a fully saturated state (25% to 27%) is stored on the other side.

Brine Transfer Pump - A selectable primary pump and a spare pump deliver the contents of the liquid storage side of the tank to the brine measuring tank. These pumps are made of bronze to minimize the corrosive effects of brine solution they pump.

INFORMATION SHEET 3-2-1 (Continued)
WATER SYSTEMS

Brine Measuring Tank - The brine measuring tank is an above ground holding tank located inside the softener enclosure. The purpose of the Brine Measuring Tank is to measure out the amount of brine we need for one full generation. The solution is delivered to the offline bed.

Regeneration Waste Tank - The waste surge tank receives the regenerated waste products not suitable for discharge to the sanitary sewer. This tank is a gravity fed underground tank that can be manually or automatically pumped to the Brine Reduction Area evaporator or drum dryers for disposal.

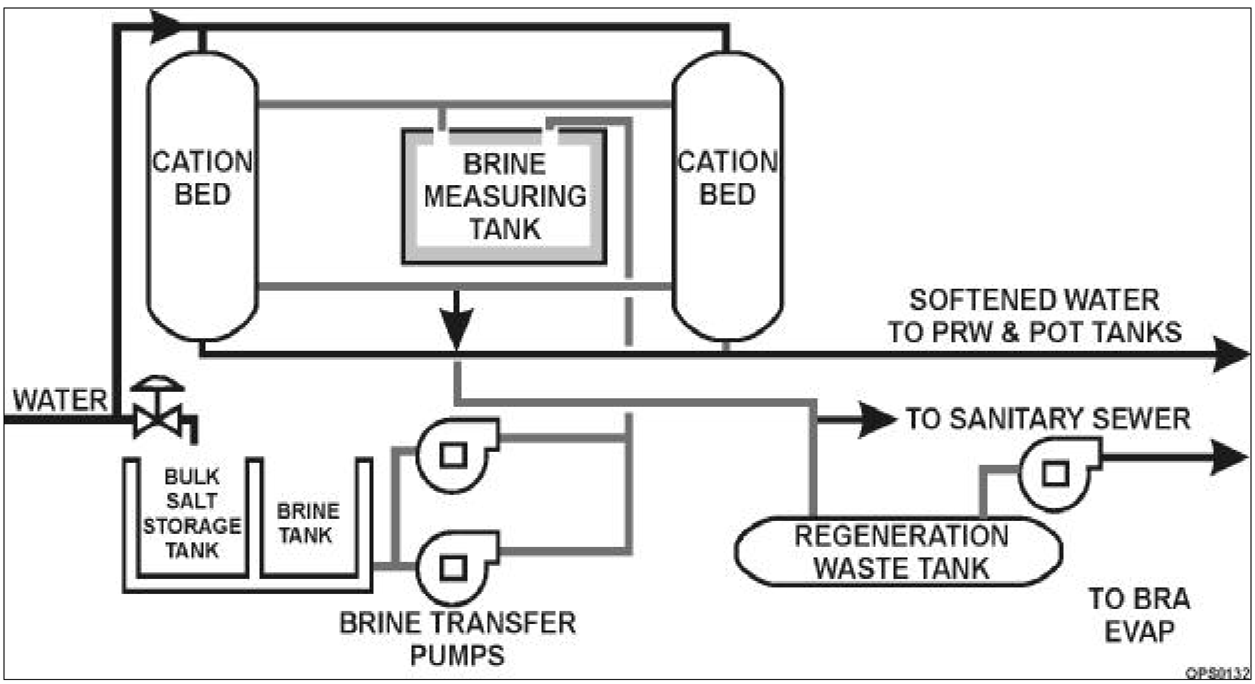

Figure 3-4: Water Treatment System

INFORMATION SHEET 3-2-1 (Continued)
WATER SYSTEMS

2. PROCESS WATER SYSTEM

SYSTEM OVERVIEW

The process water system receives softened water from the water treatment system and distributes the water to various locations throughout the site.

PROCESS DESCRIPTION/MAJOR COMPONENTS

Process Water Storage Tank

The process water storage tank provides a buffer between the water treatment system operations and the process operations. It is a carbon steel tank which is filled automatically by the control room. Thus, water for the process operations is assumed to be normally available, independent of the operations of the water treatment system or the supply water network.

Process Water Supply Pumps

Water is pumped from the process water storage tank using a three-pump system for distribution. Each pump is made of carbon steel and is driven by electric motors. They are sized to supply approximately 50% of the maximum flow required by the process. One pump normally operates as the primary supply pump with a second pump maintained as a standby supply pump, depending on the process needs. Only the primary pump is required to supply the normal demand rate of the process. The need for the standby pump is determined by flow. A third pump is maintained in a backup position in case either the primary or standby pump fails. The backup pump need is determined by the distribution line low pressure.

Recirculation Line

Pump protection is provided by a recirculation loop back to the process water storage tank. As long as the flow demand is below the minimum flow requirements of a single pump, the recirculation valve is allowed to be open by the control room, and the valve is controlled to maintain a preset minimum flow rate. If the facility demand increases to a preset flow rate, the control room causes the recirculation valve to close. The recirculation valve remains closed until the flow drops below the preset minimum flow rate. Figure 3-5 show a diagram of the Process Water System.

INFORMATION SHEET 3-2-1 (Continued)
WATER SYSTEMS

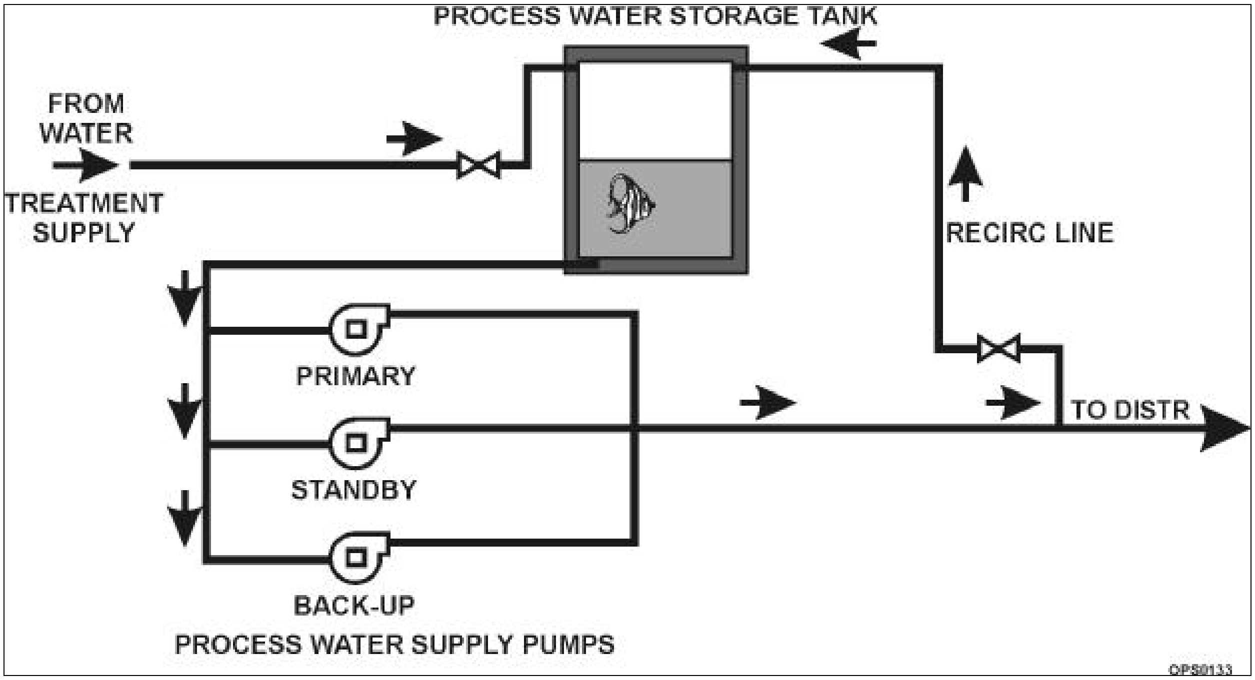

Figure 3-5: Process Water System

Process Water Distribution

Process water is distributed to through the utilities distribution network. The process water is provided to process water head tanks, the utility stations, and to other process users.

The process water head tanks are provided in airlocks in the MDB for DPE airlock decon operations. The tanks are initially pressurized to 25 psig with plant air and are maintained by a pressure regulator.

OUTLINE SHEET 3-3-1
ELECTRICAL DISTRIBUTION SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-3-1 “Electrical Distribution System”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Electrical Distribution System.

    1.1 **IDENTIFY** the purpose of the Electrical Distribution System.

    1.2 **IDENTIFY** the function of the following major components of the electrical distribution system:

    - Primary Power Supply
    - Secondary Power Supply
    - Uninterruptible Power Supply
    - Emergency Generator

    1.3 **IDENTIFY** the three categories of electrical loads

C. OUTLINE OF LESSON CONTENT

1. System Overview

    a. Primary Power System

    b. Secondary Power System

    c. Uninterruptible Power Supply (UPS) System

    d. Emergency Generator System

INFORMATION SHEET 3-3-1
ELECTRICAL DISTRIBUTION SYSTEM

A. INTRODUCTION

This information sheet describes the function of the electrical distribution system. Included is a description of the type of electrical loads and the system that supplies power to them.

B. REFERENCES

1. TOCDF Functional Analysis Workbook

2. ANCDF Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The electrical distribution system provides electrical loads with the necessary distribution, transformation, and protection of electrical power. The electrical loads are divided into three categories:

- **Critical Loads**: Electrical loads that cannot tolerate any interruption in service and that are required to maintain safe plant operations.

- **Essential Loads**: Electrical loads that can tolerate a momentary loss of power and that will be required to bring the plant operations to a safe level.

- **Utility Loads**: Electrical loads that can tolerate a loss of power at any time without harm and that are neither critical or essential.

The primary power supply is distributed by two 4160 volt switchgear buses. The secondary power distribution is performed through different 480 volt switchgears, Motor Control Centers (MCCs), and load centers. Essential power is supplied by two diesel engine-driven generator sets with 100% standby capacity. Critical loads are powered through the parallel redundant Uninterruptible Power Supply (UPS) system. Battery backup of the system provides 45 minutes of uninterrupted power in the event of a power system failure.

INFORMATION SHEET 3-3-1 (Continued)
ELECTRICAL DISTRIBUTION SYSTEM

PRIMARY POWER SYSTEM

The primary power system consists of two sections of switchgear (SWGR) as shown in Figure 3-6. A double-ended substation near the demil site receives its primary power from the local utility company. A transformer steps down the line voltage to 4160 volts and provides power to the primary power system. All loads greater than 200 hp are supplied directly from the primary power system. Each main 4160 volt switchgear is sized to handle 100% of the electrical load. During normal operations, switchgear PPS-SWGR-101 and -102 each carry 50% of the electrical load and are located in different rooms in the munitions demilitarization building. In case of a loss of power from one feeder, the other feeder carries the whole load by closing the tie breaker between the two switchgears.

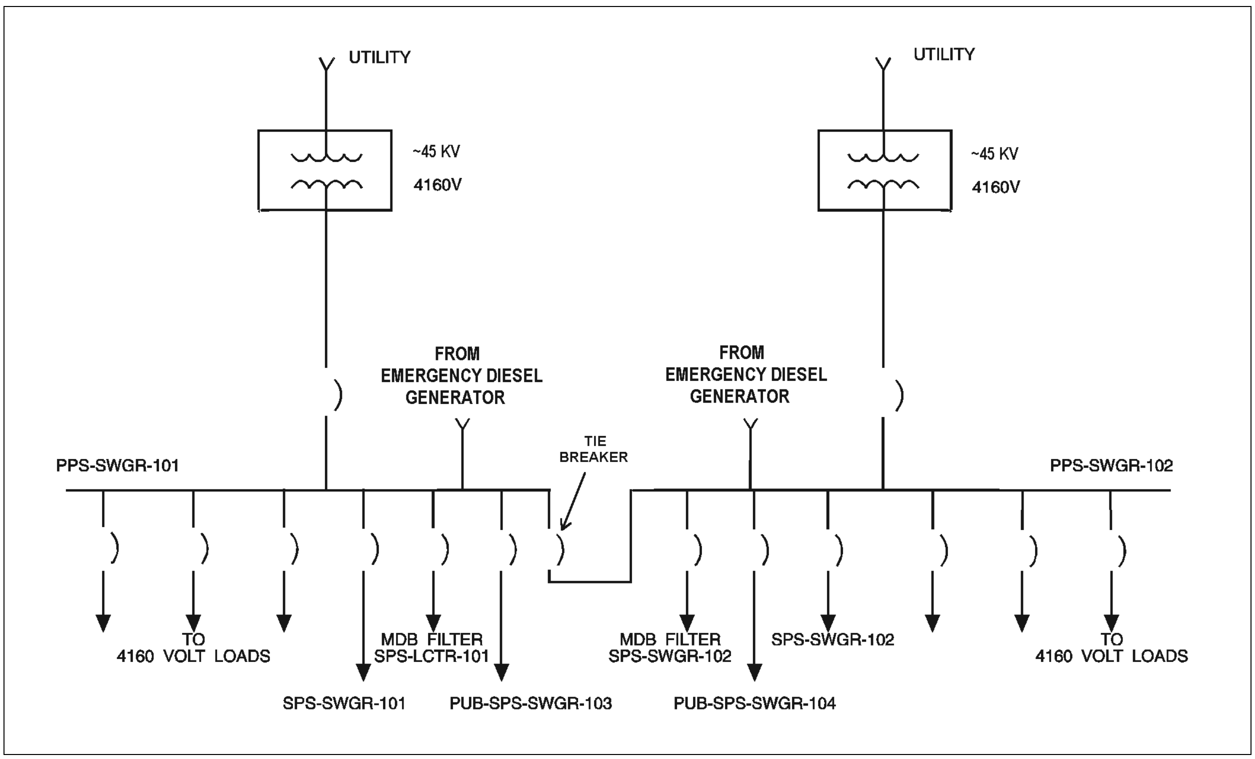

Figure 3-6: Primary Power System

INFORMATION SHEET 3-3-1 (Continued)
ELECTRICAL DISTRIBUTION SYSTEM

SECONDARY POWER SYSTEM

The secondary power system consists of 480 volt substations, load centers, motor control centers, and other equipment necessary to control and distribute power to site equipment. The secondary power system steps down the voltage received from the primary power system from 4160 volts to 480 volts through transformers. The 480 volt switchgear and load centers contain circuit breakers that control power to the secondary power system motor control centers, transformers, and UPS systems. Figure 3-7 shows the secondary power system.

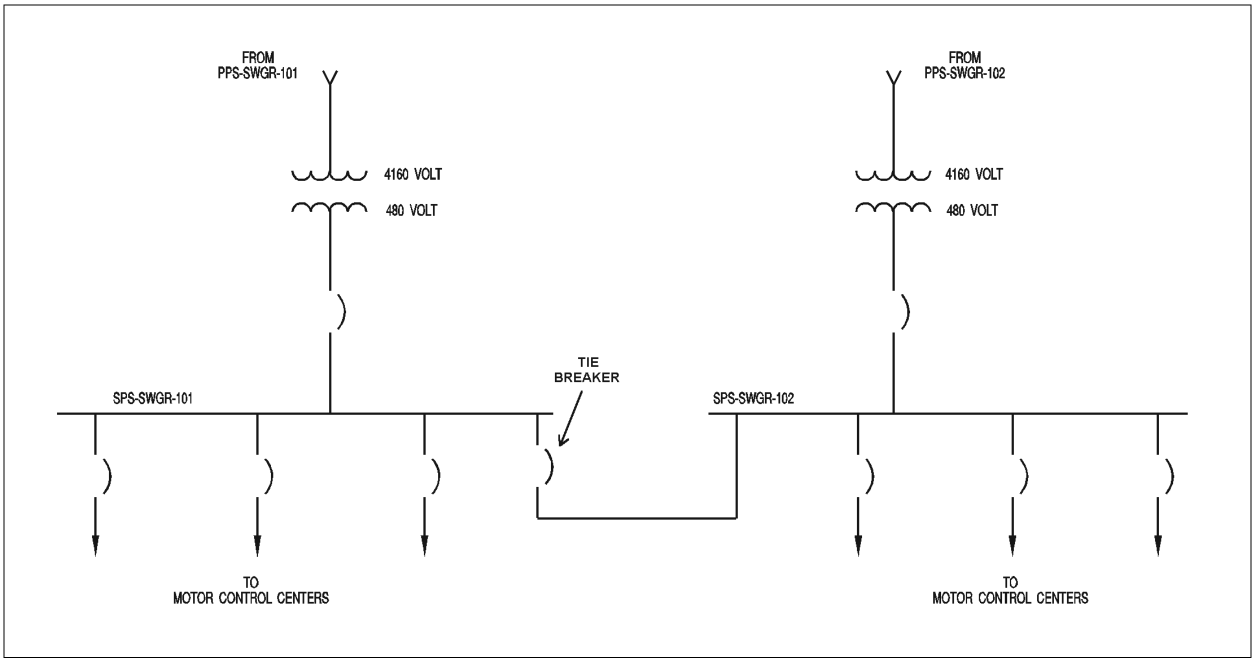

Figure 3-7: Secondary Power System

INFORMATION SHEET 3-3-1 (Continued)
ELECTRICAL DISTRIBUTION SYSTEM

Each side of the 480 volt switchgear (SPS-SWGR-101 and-102) is normally 50% loaded. In case of a loss of primary power to one side of the switchgear, the other switchgear assumes the load by opening the main breaker of the faulted switchgear, and closing the tie-breaker between the switchgear. The main breakers and the tie-breaker are hard-wire interlocked so that if both mains are closed, the tie-breaker cannot be closed when the local-remote selector switch is in the remote position. In addition, if one main and the tie-breaker are closed, the other main cannot be closed when in the remote position.

UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM

In the event of a power system failure, the UPS system provides continuous 208/120 VAC power to critical equipment loads with battery backup for 45 minutes. The UPS system consists of several different components that allow the system to maintain power under normal operations, maintenance conditions, and emergency or abnormal conditions. The batteries of each UPS module are designed to carry these loads with no interruption until the emergency generator system has started and is on line.

EMERGENCY GENERATOR SYSTEM

The emergency generator system (Figure 3-8) automatically provides 4160 VAC power to the primary power system in the event of a total failure of incoming power from the local utility company. The emergency generator system consists of two diesel-powered generators and associated support equipment.

The automatic starting of the generators takes less than 5 seconds. The generators are ready to accept load between 10 to 17 seconds of receipt of an automatic starting signal from the PLC. Full loading of the generators is accomplished within 90 seconds.

INFORMATION SHEET 3-3-1 (Continued)
ELECTRICAL DISTRIBUTION SYSTEM

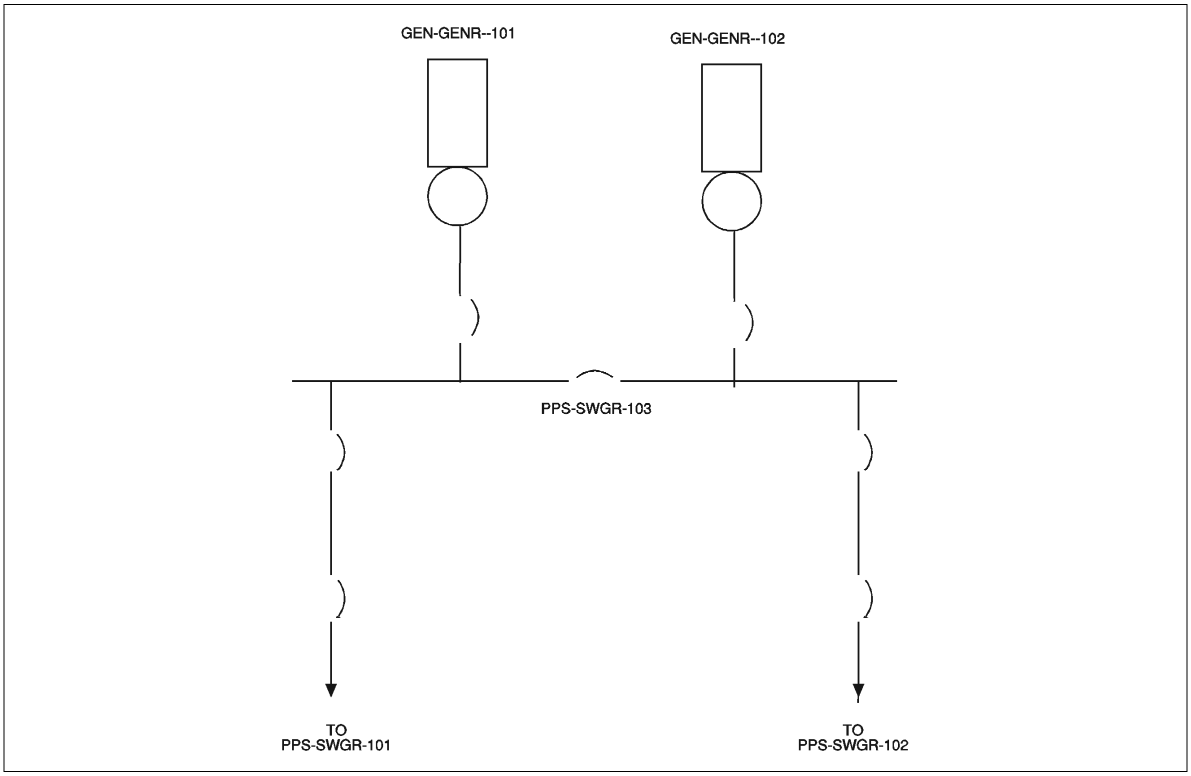

Figure 3-8: Emergency Generator System

OUTLINE SHEET 3-4-1
COMPRESSED AIR SYSTEMS

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-4-1 “Compressed Air Systems”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Plant Air System.

   1.1 **IDENTIFY** the purpose of the Plant Air System.

   1.2 **IDENTIFY** major components of the Plant Air System and state the function of each.

2. **DESCRIBE** the Instrument Air System.

   2.1 **IDENTIFY** the purpose of the Instrument Air System.

   2.2 **IDENTIFY** major components of the Instrument Air System and state the function of each.

3. **DESCRIBE** the Life Support Air System.

   3.1 **IDENTIFY** the purpose of the Life Support Air System.

   3.2 **IDENTIFY** major components of the Life Support Air System and state the function of each.

4. **DESCRIBE** the Life Support Bottle Filling System.

   4.1 **IDENTIFY** the purpose of the Life Support Bottle Filling System.

OUTLINE SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

C. OUTLINE OF LESSON CONTENT

1. Compressed Air System Overview

2. Plant Air System

    a. System Overview

    b. Major Components

        (1) Plant Air Compressors

        (2) Plant Air Dryer Package

            (a) Prefilters

            (b) Dryers

            (c) Afterfilters

        (3) Plant Air Receiver

3. Instrument Air System

    a. System Overview

    b. Major Components

        (1) Instrument Air Compressors

        (2) Instrument Air Dryer Package

            (a) Prefilters

            (b) Dryers

            (c) Afterfilters

        (3) Instrument Air Receiver

OUTLINE SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

4. Life Support Air System

    a. System Overview

    b. Major Components

        (1) Life Support Air Compressors

        (2) Life Support Air Dryer Package

            (a) Prefilters

            (b) Dryers

            (c) Afterfilters

        (3) Life Support Air Receiver

        (4) Life Support Air Cooler

5. Life Support Bottle Filling System

INFORMATION SHEET 3-4-1
COMPRESSED AIR SYSTEMS

A. INTRODUCTION

This sheet provides information on the systems that make up the compressed air systems at a chemical agent disposal facility.

B. REFERENCES

1. ANCDF Functional Analysis Workbook

2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. COMPRESSED AIR SYSTEM OVERVIEW

The compressed air systems (CAS) are used to supply high-pressure air for the facility. The compressed air systems consist of the following:

- Plant Air System
- Instrument Air System
- Life Support System
- Life Support Bottle Filling System

The basic designs of the plant air, instrument air, and life support air systems are similar. Each has two packaged air compressors, a packaged air dryer, and air storage receiver. The life support bottle filling system has a packaged air compressor with an air receiver, and cascading air cylinders for filling bottles.

INFORMATION SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

2. PLANT AIR SYSTEM

SYSTEM OVERVIEW

The plant air system provides clean dry compressed air for plant equipment operation.

The plant air system consists of redundant lubricated air compressors, a regenerative heatless desiccant dryer, and a plant air receiver. One plant air header is routed throughout the facility to supply the users, and it makes up the plant air distribution system. The plant air system takes in air from the MER, compresses it through one of two redundant compressors, dries it with an air dryer, filters it through particulate filters, and stores it in a receiver for use by the facility systems. Figure 3-9 shows the plant air system.

MAJOR COMPONENTS

Plant Air Compressors

Two redundant rotary screw air compressors, each sized for peak demand flow, compress atmospheric air to normal operating pressure.

Plant Air Dryer Package

Moisture, oil, or dirt in the compressed air supply can reduce the operability of components and can result in equipment failure. The plant air dryer package ensures that only clean dry compressed air is distributed to plant equipment.

Prefilters - Compressed air leaving the compressor flows into a common header and through coalescing prefilters. These prefilters remove gross amounts of moisture from the air. The prefilters are a duplex unit so that one filter is always on line while the other may be blown down.

Dryers - From the prefilter, the compressed air flows to one of the desiccant plant air dryers. While one dryer is absorbing moisture from the inlet air, the other is being regenerated by a portion of the dried air.

Afterfilters - The dried, compressed air leaves the dryer and passes through particulate removal afterfilters. These filters remove any particulate prior to reaching the air receiver. They are arranged in a duplex unit similar to the prefilters.

INFORMATION SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

Plant Air Receiver

The plant air receiver is a surge tank for compressed air for the users. It helps to minimize fluctuations in system pressure during periods of changing loads on the system. The receiver is sized to provide approximately 20 minutes of operation if both of the plant air compressors shut down.

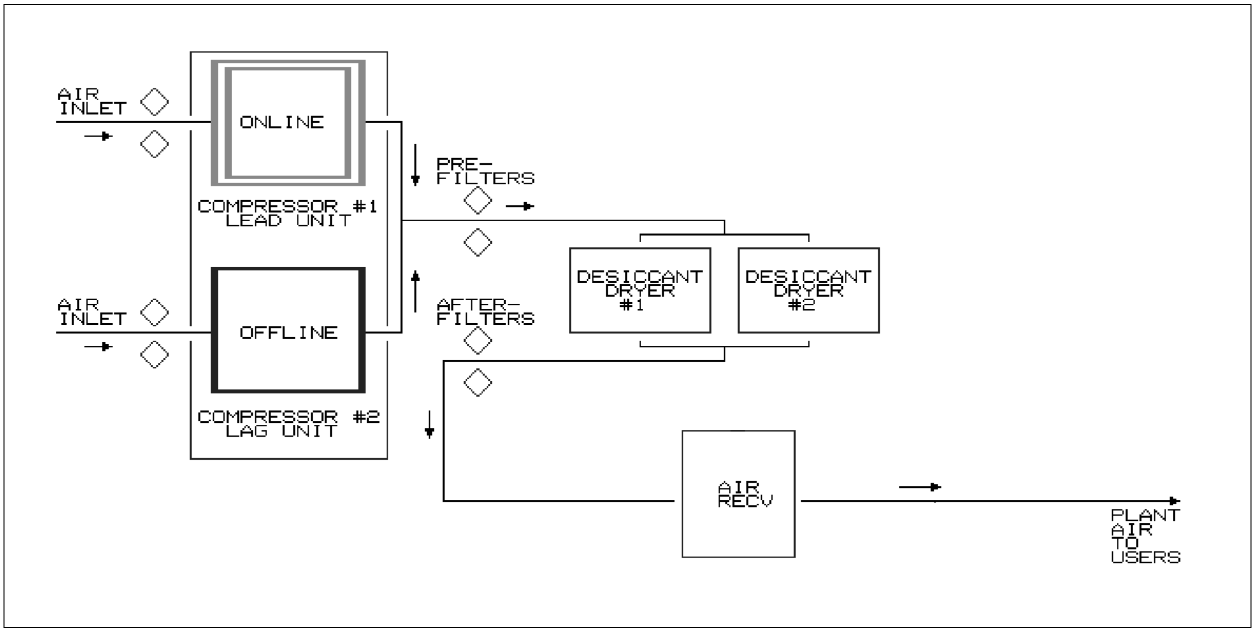

Figure 3-9: Plant Air System

INFORMATION SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

3. INSTRUMENT AIR SYSTEM

SYSTEM OVERVIEW

The instrument air system (Figure 3-10) provides compressed air to all pneumatically operated instrumentation and valves throughout the facility. The system consists of redundant non-lubricated air compressors, a heatless regenerative desiccant dryer, and an instrument air receiver. An instrument air header is routed throughout the facility to supply its users and makes up the instrument air distribution system. The instrument air system takes in air from the MER through a filter, compresses it through one of two redundant compressors, dries it with an air dryer, filters it through particulate filters, and stores it in a receiver for use by the facility systems.

MAJOR COMPONENTS

Instrument Air Compressors

Two redundant air compressors compress atmospheric air to normal operating pressure.

Instrument Air Dryer Package

Moisture, oil or dirt in the air supplied to components reduces the operability of components and can result in equipment failure. The instrument air dryer package ensures that only clean, dry compressed air is supplied to instrument equipment.

Prefilters - Compressed air leaving the compressor flows into a common header and through a coalescing prefilter. These prefilters remove gross amounts of moisture in the air. The prefilters are a duplex unit so that one filter is always on line while the other may be blown down.

Dryers - From the prefilters, the compressed air flows through one of the desiccant instrument air dryers. While one bed is absorbing moisture from the inlet air, the other is regenerated by a portion of the dried air.

Afterfilters - The dried, compressed air leaves the dryer cylinders and passes through particulate removal afterfilters. These filters remove any particulate prior to reaching the air receiver. They are arranged in a duplex unit similar to the prefilters.

INFORMATION SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

Instrument Air Receiver

The instrument air system receiver stores compressed air for users. The receiver is sized to provide approximately 15 minutes of operation should the compressors both be shut down. This allows all users to perform an orderly shutdown.

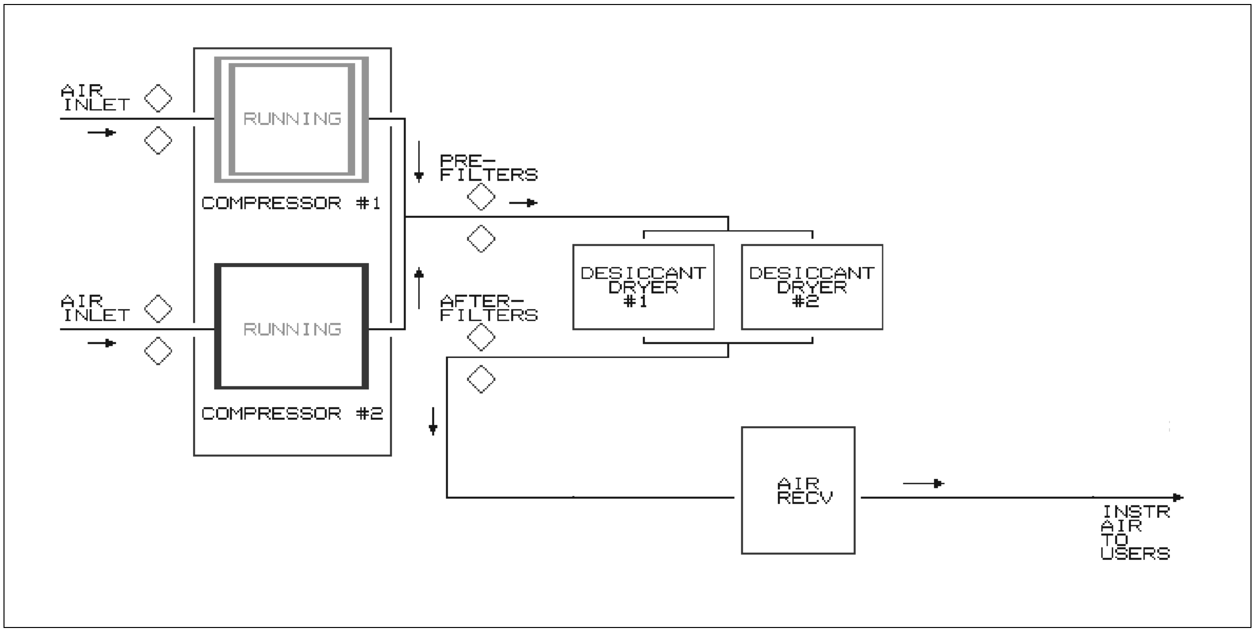

Figure 3-10: Instrument Air System

INFORMATION SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

4. LIFE SUPPORT AIR SYSTEM

SYSTEM OVERVIEW

The Life Support Air System (Figure 3-11) provides compressed air to the facility for primary breathing and cooling air to the Demilitarization Protective Ensemble (DPE) wearer. The life support air stations provide the connection point for DPE air hoses.

The life support air system consists of redundant, non-lubricated, air compressors with high-efficiency particulate air (HEPA) filters and chemical, biological, and radiological (CBR) inlet air filters; redundant, regenerative, heatless desiccant dryers; an air receiver; and an air cooler.

The life support air system takes in air from the MER, compresses it through one of two redundant compressors, dries it with an air dryer, filters it through charcoal filters, stores it in a receiver, and cools it for use.

MAJOR COMPONENTS

Life Support Air Compressors

Two redundant air compressors compress atmospheric air to normal operating pressure. The piston and cylinder assembly is non-lubricated to prevent oil contamination of the air system. A HEPA and carbon filter assembly is installed on the compressor suction to prevent contamination of the air supply in the event of a toxic release to the environment. Each compressor is designed to provide ten personnel in DPE suits with air at a rate of 10 scfm.

Life Support Air Dryer Package

The dryer package ensures that only clean dry compressed air is supplied to personnel in DPE suits. Breathing air must NOT contain oil, dirt, or excessive moisture.

Prefilters - Compressed air leaving the compressor flows through an air receiver into a common header and into a coalescing prefilter. These filters remove gross amounts of moisture, particulate, and oil in the air prior to reaching the dryer unit. The prefilters are a duplex unit so that one filter is always on line while the other may be blown down.

INFORMATION SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

Dryers - From the coalescing prefilters, the compressed air flows to the desiccant life support air dryers. The dryers are controlled so that one is used for drying while the other is being regenerated by a portion of the dried air.

Afterfilters - The dried, compressed air leaves the dryer and passes through catalytic and charcoal filters to provide breathable quality air for the life support air receiver. The moisture content of the air leaving the afterfilters is indicated in the control room, along with a high moisture alarm and a moisture analyzer malfunction alarm. Separate high carbon monoxide (CO) and analyzer malfunction alarms are also indicated in the control room.

Life Support Air Receiver

The life support air receiver stores breathable compressed air for users. The receiver is sized to provide approximately 200 man minutes of operation should both compressors be shut down. The sizing is based on supplying 10 scfm per man at a minimum pressure of not less than 90 psig.

Life Support Air Cooler

The life support air cooler is an exchanger that uses the chilled water supply to cool the life support air out of the air receiver.

INFORMATION SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

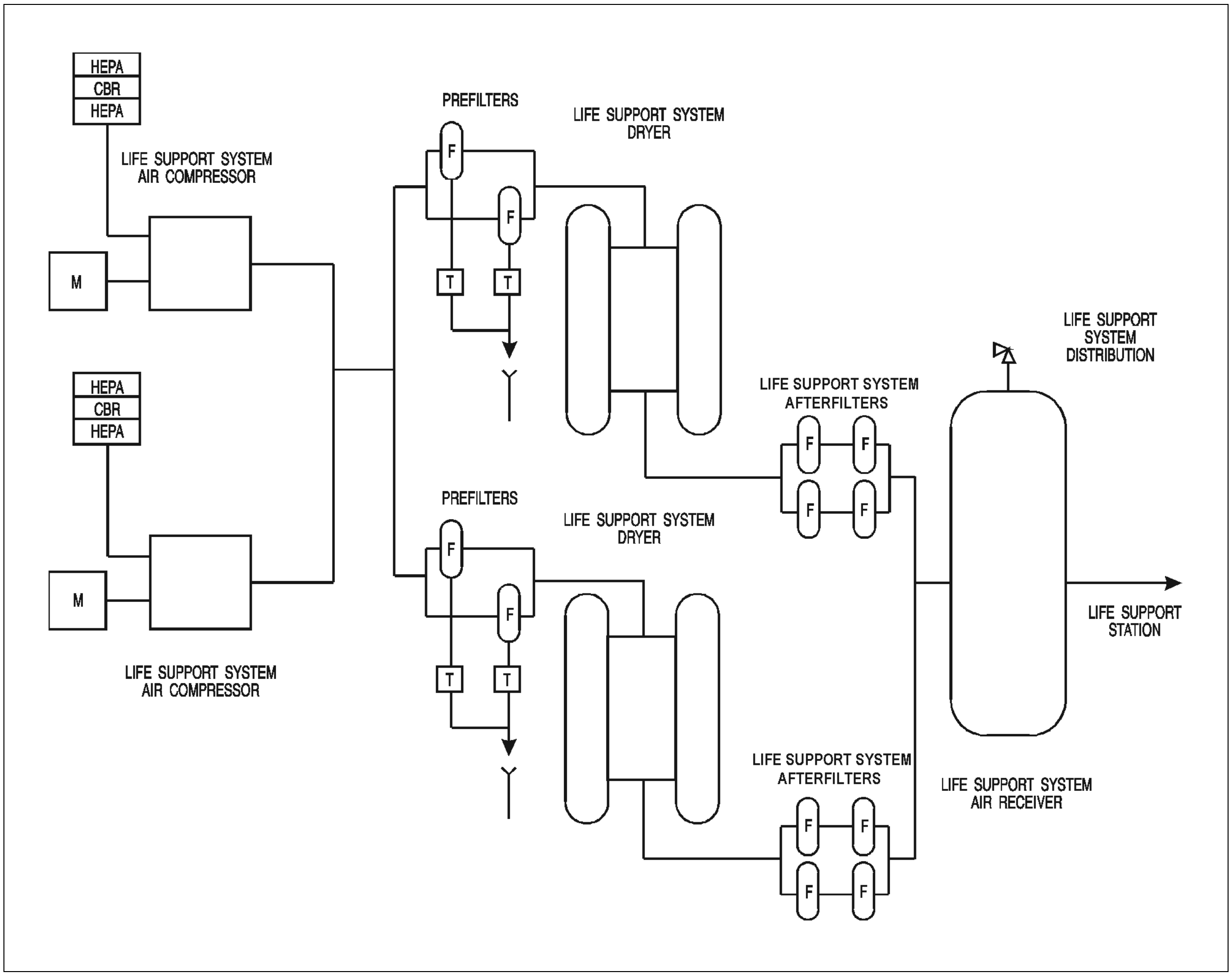

Figure 3-11: Life Support Air System

INFORMATION SHEET 3-4-1 (Continued)
COMPRESSED AIR SYSTEMS

5. LIFE SUPPORT BOTTLE FILLING SYSTEM

The life support bottle filling system (Figure 3-12) provides high-pressure air to charge:

- Emergency Air Bottles (attached to the DPE respirator package)
- Air Cylinders [attached to the DPE transport vehicle and other self-contained breathing apparatus (SCBA)-type respirators].

The system consists of a lubricated air compressor package with an intake air purification package and air cylinders.

To ensure safe filling procedures, the cylinders are manifolded in pairs so that one pair can be charged by the compressor while the other pair is being used to charge the air bottles. The life support bottle filling system also provides low pressure breathing air (125 psig) to the DPE support area to allow the dressing of personnel into DPE suits.

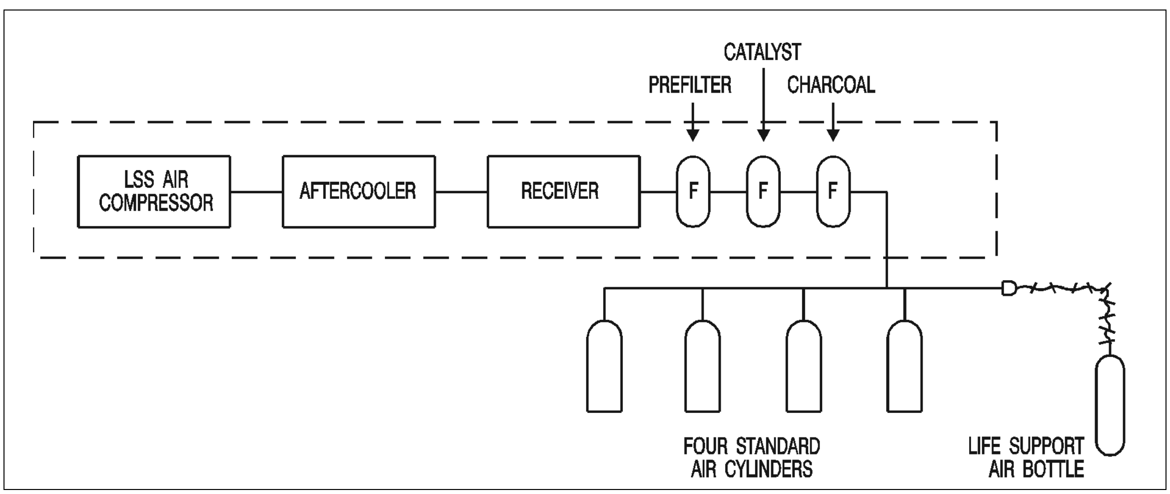

Figure 3-12: Life Support Bottle Filling System

OUTLINE SHEET 3-5-1
HVAC SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-5-1 “HVAC System”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Hot Water Heating System.

    1.1 **IDENTIFY** the purpose of the Hot Water Heating System.

    1.2 **IDENTIFY** the function of the Hot Water Heating System major components.

2. **DESCRIBE** the Chilled Water System.

    2.1 **IDENTIFY** the purpose of the Chilled Water System.

    2.2 Given a block diagram, **LABEL** the major components of the chilled water system

    2.3 **IDENTIFY** the function of the Chilled Water System major components.

3. **DESCRIBE** the Ventilation System

    3.1 **IDENTIFY** the purpose of the Ventilation System.

    3.2 **IDENTIFY** the primary means of preventing release or spread of contamination.

    3.3 **IDENTIFY** the room categories from most negative to least negative.

    3.4 **IDENTIFY** the function of the Ventilation System major components.

OUTLINE SHEET 3-5-1 (Continued)
HVAC SYSTEM

C. OUTLINE OF LESSON CONTENT

1. HVAC System Overview

2. Hot Water Heating System

   a. System Overview

   b. Major Components/Process Description

      (1) Boiler Packages

      (2) Circulation Pumps

      (3) Expansion Tanks

3. Chilled Water System

   a. System Overview

   b. Major Components

      (1) Chiller Units

      (2) Condensers

      (3) Receivers

      (4) Chilled Water Pumps

      (5) Chilled Water Expansion Tank

OUTLINE SHEET 3-5-1 (Continued)
HVAC SYSTEM

4. Ventilation System

   a. System Overview

      (1) Room Categories

   b. Process Descriptions

      (1) MDB Cascade HVAC System

      (2) Furnace Room Heating and Ventilation System

      (3) Control Room HVAC System

   c. Major Components

      (1) Supply Air Handling Unit

      (2) Exhaust Air Filtration Units

      (3) Exhaust Stack

      (4) Supply Air Filtration Unit

      (5) Inlet Filter Unit

      (6) Fire Dampers

      (7) Blast Valves

      (8) Flow Isolation Dampers

      (9) Ventilation Fans

INFORMATION SHEET 3-5-1
HVAC SYSTEM

A. INTRODUCTION

This information sheet discusses the subsystems of the HVAC System, which includes the hot water heating system, chilled water system, and ventilation system. A brief description of their functions and major components is covered.

B. REFERENCES

1. Programmatic Functional Analysis Workbook

2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. HVAC SYSTEM OVERVIEW

The Heating, Ventilation, and Air Conditioning (HVAC) system of the Munitions Demilitarization Building (MDB) is one of the most important systems at the demilitarization facility. The proper operation of the HVAC system is required to maintain containment of the toxic areas of the MDB while providing space heating and air conditioning for toxic and non-toxic areas.

2. HOT WATER HEATING SYSTEM

SYSTEM OVERVIEW

The Hot Water Heating System provides hot water for heating the buildings at the demil site. It consists of the HVAC Central Hot Water Heating System as shown in Figure 3-13. This system is located in a non-toxic area.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

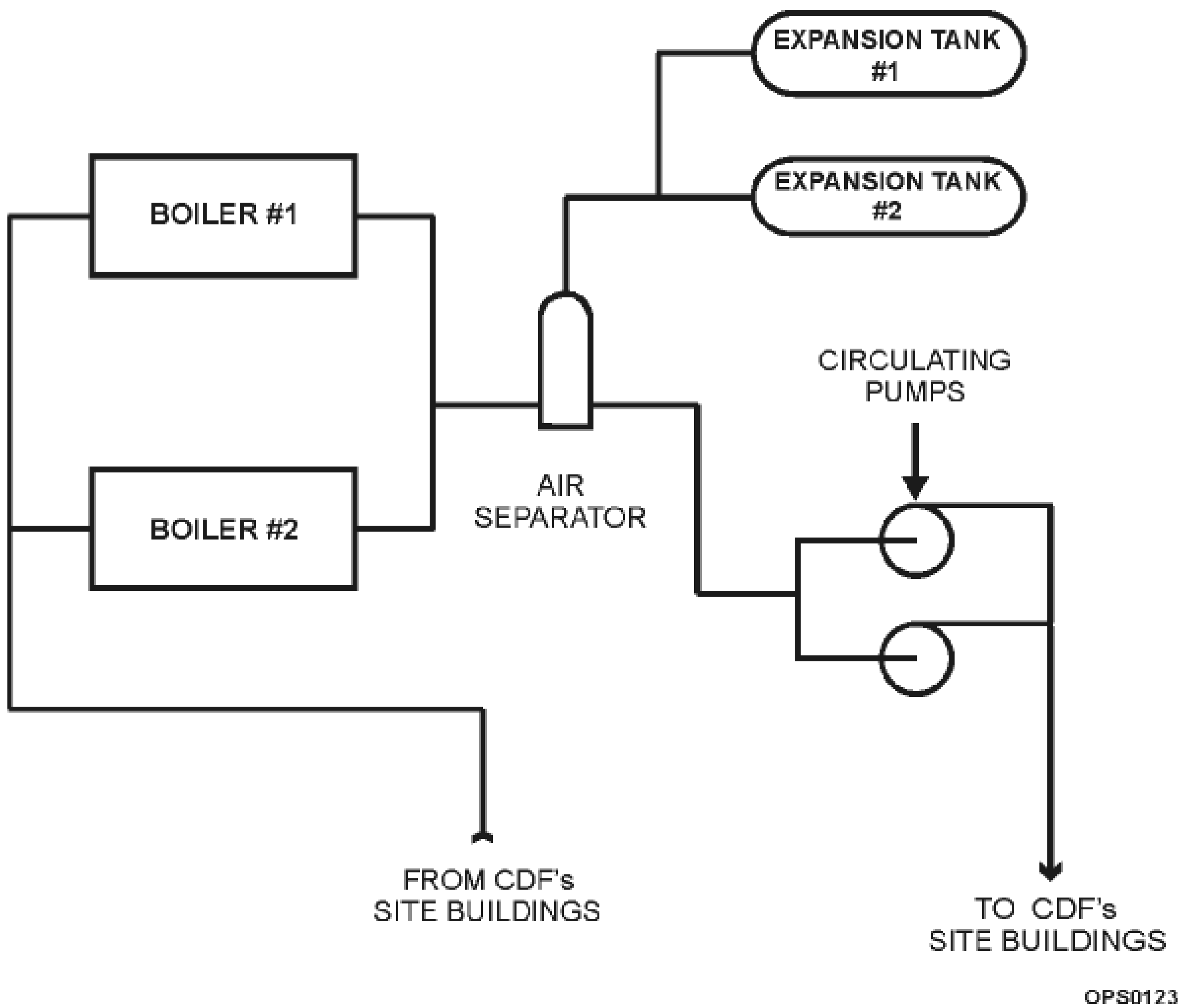

Figure 3-13: Hot Water Heating System

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

MAJOR COMPONENTS/PROCESS DESCRIPTION

Boiler Packages

The Boiler Package consists of two fuel gas fired boilers installed in parallel configuration, two hot water circulating pumps, and associated controls and instrumentation. The boiler packages raise the temperature of water passed through them to approximately 180 °F.

Circulation Pumps

Hot water is directed to buildings from the PUB boilers by a piping distribution system. This system uses two pumps to circulate water from the boilers to air handling units and unit heaters in the PUB, MDB, CHB, PMB, and the PAS.

Expansion Tanks

Two diaphragm type expansion tanks are installed to provide a surge volume for the hot water distribution system.

3. CHILLED WATER SYSTEM

SYSTEM OVERVIEW

The Chilled Water System provides cooling water for the Heating, Ventilation and Air Conditioning System (HVAC). Chilled water is directed to the cooling coils of the supply air handling units. Air flows past the cooling coils where it is cooled and then transferred through the building. There are two separate HVAC Systems in the Munitions Demilitarization Building (MDB), one for the Control Room and one for Process Areas. Each HVAC system has its own chilled water system. Figure 3-14 is representative of both systems since they are similar in construction and operation.

Both systems are divided into two processes, the refrigerant process and the chilled water process. The refrigerant and chilled water do not directly mix with one another. The piping in which each is contained run adjacent to one another. Through conduction, the heat of the chilled water is transferred to the refrigerant. The chilled water side removes heat from components to cool them and transfers the heat to the refrigerant side. The refrigerant side transfers heat received from the chilled water to the atmosphere.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

MAJOR COMPONENTS

Chiller Units

The Chiller Units transfer heat from the chilled water to the refrigerant. These units contain the refrigerant compressors and the refrigerant evaporators. The compressor provides the motive force to drive the refrigerant side by pumping refrigerant from the evaporator to the condenser. The evaporators are heat exchangers that transfer heat from chilled water to the refrigerant. They provide the boundary between the chilled water and the refrigerant. These components are called evaporators because the refrigerant flashes from liquid to vapor as it picks up heat from the chilled water.

Condensers

The Refrigerant Condensers remove heat from the refrigerant returning it to a liquid state. Each condenser consists of a horizontal heat exchanger that the refrigerant passes through. Three fans are mounted over the heat exchanger to cool the refrigerant. The Control Room system has two condensers. The Process Area Condensers are dual condenser units.

Receivers

Each refrigerant condenser has a receiver for liquid refrigerant storage and surge volume. Refrigerant bypassing the condensers also is piped to the receivers. The Process Area condenser units each share a receiver.

Chilled Water Pumps

The Chilled Water Pumps circulate chilled water from the chiller units to the components using chilled water for cooling in a closed cycle. Each chilled water system has two pumps in a parallel configuration.

Chilled Water Expansion Tank

The Chilled Water Expansion Tank provides a surge volume for the chilled water side. The expansion tank also provides for the addition of makeup from the process water system. The Control Room system uses a 50% ethylene glycol and process water mixture for chilled water. The Process Area system uses process water for chilled water. Chilled water overpressure protection is installed on each expansion tank.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

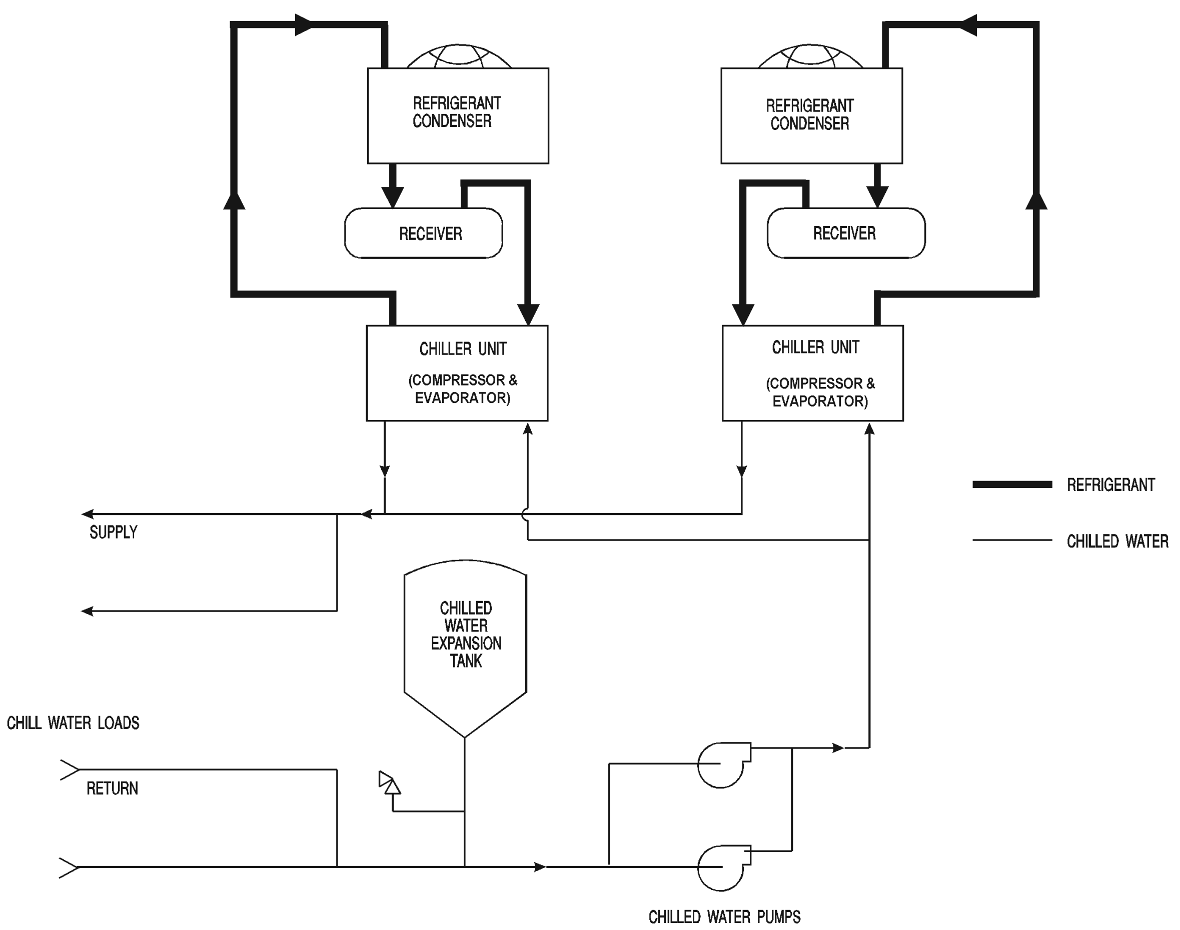

Figure 3-14: Chilled Water System

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

4. VENTILATION SYSTEM

SYSTEM OVERVIEW

The cascade ventilation system serves a fourfold purpose:

(1) Provide a constant volume of air in quantities sufficient to dilute any concentration of agent vapor that could be present.
(2) Maintain the flow of air from areas of low contamination probability to areas of higher contamination probability.
(3) Eliminate the possibility of releasing contaminants to the atmosphere.
(4) Provide for human comfort.

The primary means of preventing the release or spread of contamination is through the use of cascaded pressure control. The Control Room is maintained at a positive pressure with respect to the atmosphere, while toxic areas are maintained at a negative pressure with respect to the atmosphere.

The building ventilation flow is also set up so that air flows from the least toxic to the most toxic areas. The amount of air changed in each room is higher for areas likely to be contaminated. This minimizes the spread of contamination, and maintains the toxic boundaries. Air flow is controlled by modulating the supply air into the building, by modulating the exhaust flow of air out of the building, and by setting weighted dampers throughout the building.

Room Categories

Each room in the MDB has a designated category rating of A, A/B, B, C, D, or E based upon the potential for agent contamination. Figure 3-15 shows the basic flow path and room pressures.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

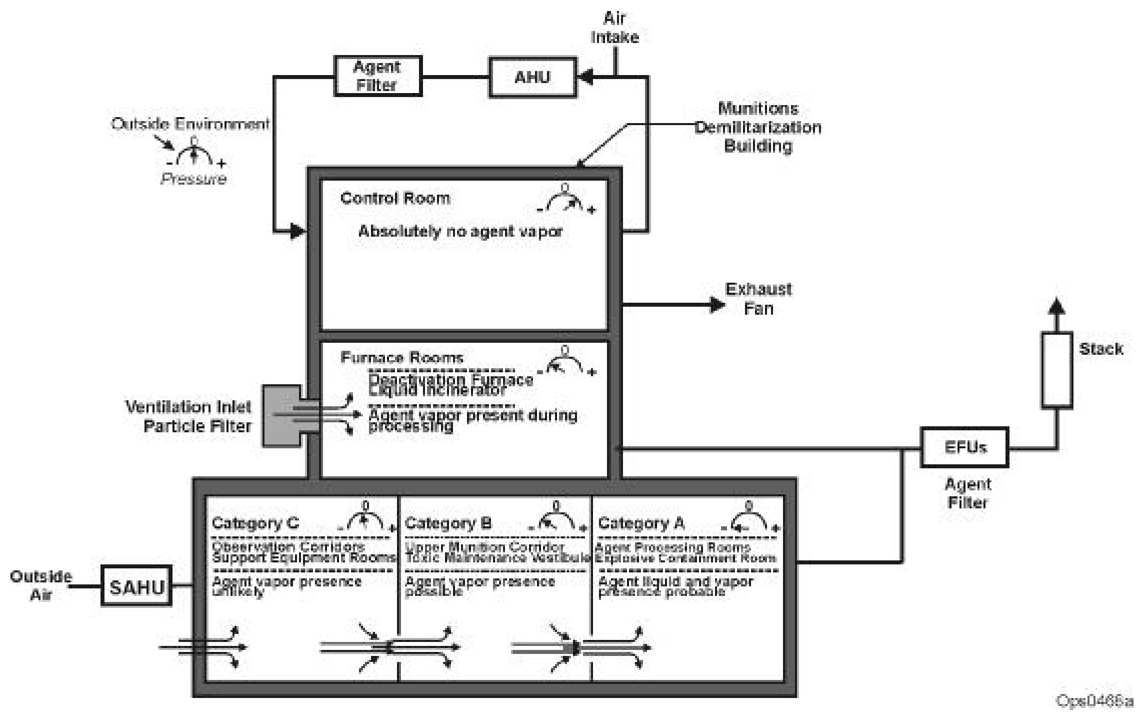

Figure 3-15: Basic Ventilation Scheme

Only rooms with Category A, A/B, B, or C ratings are maintained under a continuous negative pressure of the cascaded pressure control HVAC system. The required minimum flow rates and acceptable pressure ranges for each category are specified in Table 3-1. The vacuum is maintained by pulling a combined constant air volume at a rate of approximately 60,000 ft^3/min through the rooms. A Category E rating is maintained with a continuous positive pressure by the HVAC system with respect to the atmosphere.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

TABLE 3-1: ROOM AGENT VENTILATION CATEGORY SPECIFICATIONS

Category	Definition	Ventilation Rate	Pressure
A (process)	Areas with a high probability of contamination, either agent liquid or vapor	20 (air changes/hour, minimum)	2.10 to 0.70 (in. w.c.)
A (airlock)		60 (air changes/hour, minimum)	1.0 to 0.75 (in. w.c.)
A/B (process)	Areas with either Category A or B classification for different occasions, depending on the nature of the process undertaken at the time	20 (air changes/hour, minimum) [except for the munitions corridor (rooms 05-210), which is 10]	1.15 to 0.70 (in. w.c.)
A/B (airlock)			
B (process)	Areas with a high probability of agent vapor contamination resulting from routine operations	10 (air changes/hour, minimum)	0.95 to 0.55 (in. w.c.)
B (airlock)		30 (air changes/hour, minimum)	0.9 to 0.6 (in. w.c.)
C (process)	Areas with low probability of agent vapor contamination	6 (air changes/hour, minimum)	0.80 to 0.25 (in. w.c.)
C (airlock)		30 (air changes/hour, minimum)	0.45 to 0.35 (in. w.c.)
D	Areas (e.g., equipment rooms) unlikely to ever have agent contamination	Industry standard [1]	atmospheric
E	Areas maintained to be free from any chance of agent contamination - barring a catastrophic event	Industry standard [1]	+0.10 to +0.25 (in. w.c.)

[1] Minimum ventilation rates are not specified for non-agent areas, however industry standard flow rates apply.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

PROCESS DESCRIPTIONS

The major aspects of the HVAC system include:

- MDB cascade HVAC system
- Furnace room heating and ventilation system
- Control Room HVAC system

MDB Cascade HVAC System

The MDB cascade ventilation system is a complex system that uses two basic control philosophies: push-pull and induced draft. The design of each part of this system is dictated by three major constraints:

- Personnel protection
- Environmental protection
- Equipment protection

Personnel protection is accomplished by maintaining minimum airflow rates throughout the MDB. Air sweeps the process areas clean of agent vapor contamination and also provides a negative pressure environment that ensures agent vapor containment. This sweep protects both the people working in the MDB and the environment. Equipment protection is directed primarily at the furnace rooms because of the heat given off by the demilitarization furnaces. This heat requires a constant source of air for cooling while the furnace is hot.

The vacuum source is provided by a bank of exhaust air filtration units. Seven of the nine filter units operate at any one time; one is placed in standby, the other in backup (PBCDF has eight exhaust filtration units with six normally operating). The sweep air is provided by a bank of supply air-handling units. Two of the three supply air-handling units operate at any one time; however, this scenario depends on the number of filter units operating. Three exhaust air filtration units operating at one time require one supply air-handling unit to operate.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

Furnace Room Heating and Ventilation System

The furnace rooms (LIC, DUN, DFS, and MPF) are supplied air separately from the rest of the MDB. Air enters a given furnace room by either an outside air intake or by the direct transfer of air through isolation dampers from an adjacent space. The LIC room is provided with cooling coils. The DFS room receives cool air from the mechanical equipment room (MER), which is provided with cooling coils (the DFS room at PBCDF receives air from the outside, not the MER). Although the furnace combustion air is used for furnace heating [then exhausted through the Pollution Abatement Systems (PAS)], the remainder of the room air is exhausted through the exhaust air-filtration units.

Control Room HVAC System

The functions of the Control Room HVAC system are to maintain the required positive-pressure relationship between the Control Room and the MDB process areas, control equipment cooling, and provide human comfort.

Conditioned outside air is filtered and recirculated through the Control Room and various personnel-occupied support rooms by one of two air-handling units. Approximately 9% continuous makeup outside air is required to replace air exhausted to the atmosphere. The Control Room and the adjacent spaces are pressurized to +0.10" w.c. to prevent any possible contaminant from entering the rooms. All other areas are maintained at atmospheric pressure.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

MAJOR COMPONENTS

Supply Air Handling Unit

Conditioned air is supplied to the MDB through the use of supply air handling units. The filters on the inlet of the air handling unit are used to remove dust contained in the air. The units have heating coils which are supplied by hot water and cooling coils supplied by chilled water. A blower on the unit is used to pull in air from the outside and deliver the air to the room being supplied.

During normal processing, two air handling units are on the line, with the third air handling serving as a spare. Figure 3-16 shows a basic cross sectional view of an air handling unit.

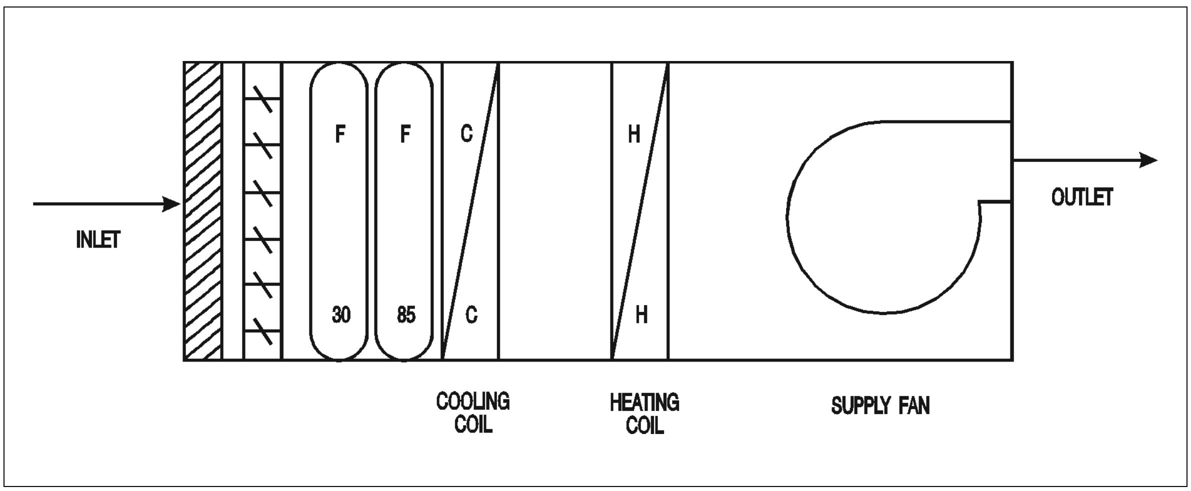

Figure 3-16: Supply Air Handling Unit

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

Exhaust Air Filtration Units

Air removed from the toxic areas of the MDB must be filtered prior to being exhausted to the environment. Exhaust air filtration units serve two purposes. First by exhausting air from a toxic area, the exhaust air filtration units develop the negative pressure in the toxic areas. Second, the exhaust air filtration units contain the filter media which is used to ensure that agent is not released to the environment.

Typically, seven exhaust filtration units are on line with the other two units serving as spares. Exhaust Air Filtration Units are used to exhaust from the toxic areas of the MDB, and are located in the filter area of the plant.

An exhaust air filtration unit contains three types of filters, each filter serving a specific function. Figure 3-17 shows a basic diagram of an exhaust air filtration unit.

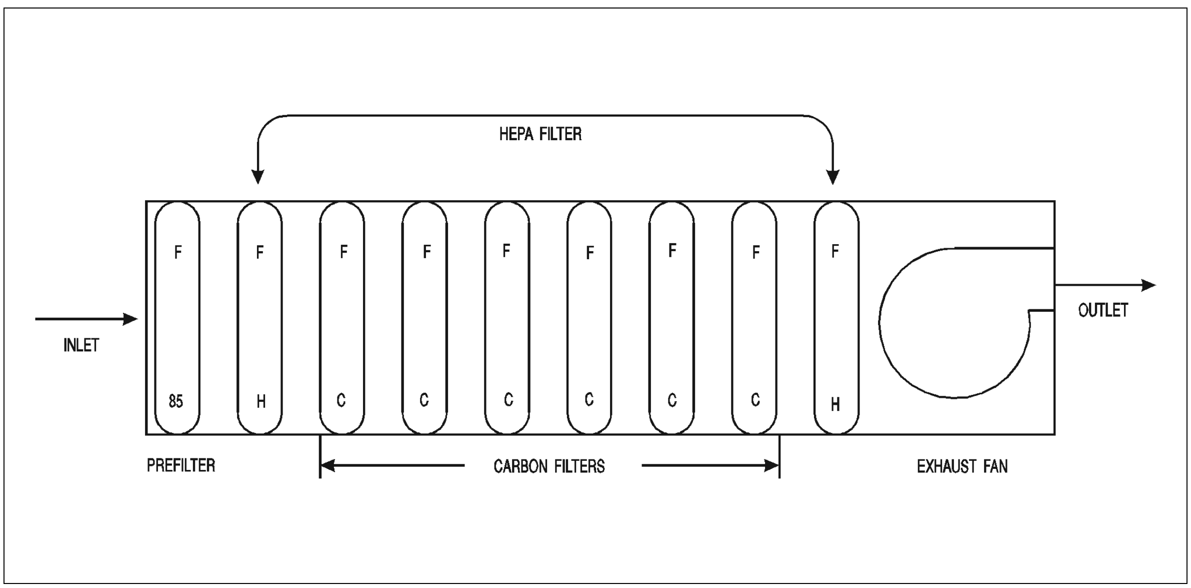

Figure 3-17 Exhaust Air Filtration Units

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

The first filter, or prefilter as it is commonly called, is used to remove any large dust or particulate matter in the air. This filter has an 85% efficiency rating. This minimizes the loading on the next stage of filters which are more expensive.

The first stage high efficiency particulate air (HEPA) filter on the inlet of the exhaust air filtration unit is used to remove any fine particulate matter exhausted from the toxic areas of the MDB. The HEPA filter at the end of the exhaust air filtration unit is used to capture any charcoal which may have broken free from the filter housing.

Charcoal filters make up the majority of an exhaust air filtration unit. Six charcoal filters aligned in series are used to remove any agent which may be present in the vapor phase as air is exhausted from the toxic areas of the MDB. The charcoal is used to adsorb the agent, preventing any release to the environment. ACAMS monitor for agent after charcoal filter #1, #2, and #4 in each Exhaust Filtration Unit.

A blower on the downstream side of the exhaust air filtration unit is used to provide the air flow from the toxic areas through the filters and out the stack.

Exhaust Stack

Air which has been filtered through the bank of exhaust air filtration units is emitted from a common stack. Air which is exhausted through the stack is continuously monitored for the presence of agent.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

Supply Air Filtration Unit

The Control Room and Engineering and Maintenance Room must operate under all conditions, especially under emergency conditions which may involve an accident concerning agent. In order to allow the continuous operations of the Control Room, the supply air is filtered through a Supply Air Filtration Unit as shown in Figure 3-18. This unit contains a prefilter, HEPA, and carbon filters.

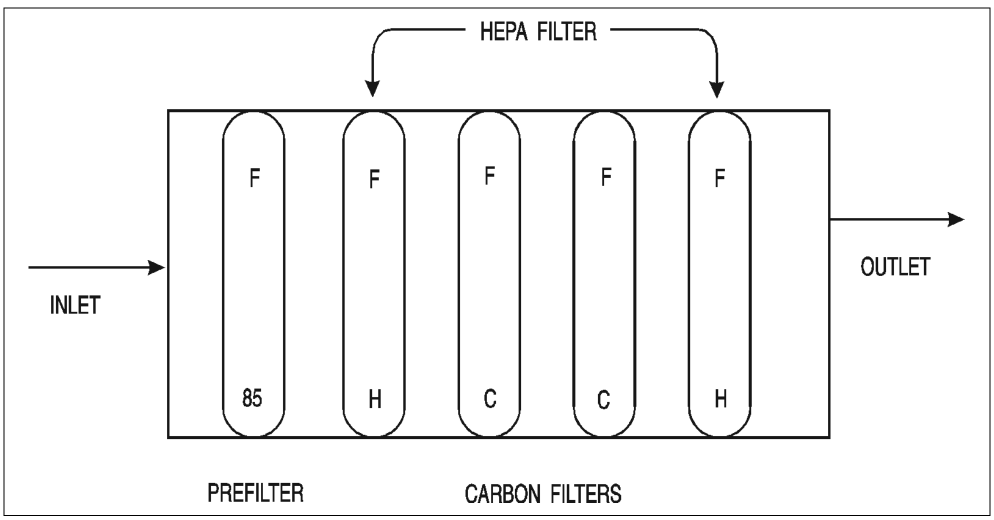

Figure 3-18: Supply Air Filtration Unit

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

Inlet Filter Unit

The Metal Parts Furnace (MPF) Room, the Dunnage Furnace (DUN) Room, and Liquid Incinerator (LIC) Room receive supply air through the use of an inlet air filter unit, as shown in Figure 3-19. The inlet air filter unit allows air from the outside to be drawn in due to the negative pressure formed in the room by the exhaust air filtration units.

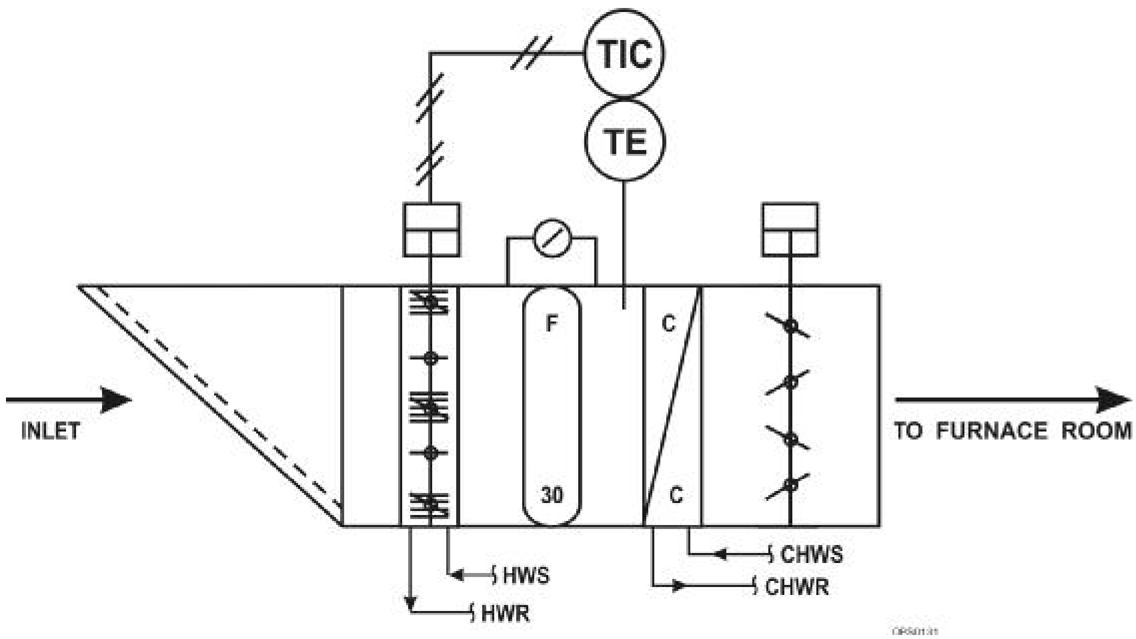

Figure 3-19: Inlet Air Filter Unit

An inlet air filter unit contains a filter on the inlet side to remove dust contained in the air. A heating coil on the unit is used in the winter to heat the air entering the room. Dampers on the unit modulate to control the flow of air into the room.

INFORMATION SHEET 3-5-1 (Continued)
HVAC SYSTEM

Fire Dampers

The HVAC System contains components which aid in preventing the spread of fire in the event that an accident occurs within the building. Motor operated fire dampers are located in portions of the exhaust duct header which pass through fire rated walls, and isolate the duct in the event of a fire alarm condition in the associated room. Fire dampers automatically close if a signal is received from the associated fire control panel.

Blast Valves

Blast valves are also located in the supply and exhaust headers of the ECR and Deactivation Furnace Room. The blast valves serve to isolate these areas in the event of an explosion.

Blast valves are special design valves that close directly upon sensing a pressure wave greater than 0.5 psi. They remain closed as long as the pressure is above the initial closing pressure after an explosion. These valves can remain closed from three milliseconds to several minutes after the event. The flow isolation dampers are used to maintain the seal starting 0.5 to 1 second after the event.

Flow Isolation Dampers

Flow Isolation Dampers are located between A, A/B, or B rooms and Category C rooms to prevent migration of chemical agent to a higher-pressure area in case of a chemical spill or power failure. The Flow Isolation Dampers can be individually closed and opened. In addition, a master isolation command can be issued from the Control Room to open or close all flow isolation dampers simultaneously. The master isolation command is interlocked to prevent closing of dampers when any Exhaust Air Filtration Unit is operating.

Ventilation Fans

Miscellaneous areas of the MDB have ventilation systems which consist of intake or exhaust fans for once through ventilation. Ventilation fans are used to remove noxious fumes or to prevent a buildup of hazardous gases, such as hydrogen from the Battery Room.

OUTLINE SHEET 3-6-1
FIRE DETECTION & PROTECTION

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-6-1 “Fire Detection and Protection”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Fire Detection and Protection System.

   1.1 **IDENTIFY** the purpose of the Fire Detection and Protection System.

   1.2 **STATE** the five systems which make up the Fire Detection and Protection System.

   1.3 **IDENTIFY** the four types of fire detectors used at a Chemical Agent Disposal Facility.

C. OUTLINE OF LESSON CONTENT

1. System Overview
2. Major Components
   a. Fire Detection and Alarm System
   b. Automatic Sprinkler System
   c. Fire Extinguishing Medium (FEM) System
   d. Dry Chemical System
      (1) Toxic Cubicle
   e. High Speed Deluge System
3. Portable Fire Extinguishers

INFORMATION SHEET 3-6-1
FIRE DETECTION & PROTECTION

A. INTRODUCTION

This information sheet provides a description of all the systems that make up the Fire Detection and Protection System.

B. REFERENCES

1. ANCDF Functional Analysis Workbook

2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The Fire Detection and Protection System provides automatic detection and annunciation of a fire occurrence throughout the plant. The system also provides automatic extinguishing of a fire occurrence for specific areas. Portable fire extinguishers, manual pull stations, and alarm horns are provided throughout the plant.

INFORMATION SHEET 3-6-1 (Continued)
FIRE DETECTION & PROTECTION

2. MAJOR COMPONENTS

Five different fire detection and extinguishing systems are part of the Fire Detection and Protection System.

- Fire detection and alarm system
- Automatic sprinkler system
- Fire Extinguishing Medium (FEM) system
- Dry chemical system
- High-speed deluge systems

Automatic fire-extinguishing systems are provided in the critical locations of the facility. The table below shows the location, type, and detectors of the automatic fire-extinguishing systems.

Table 3-2: Automatic Fire-Extinguishing Equipment

Location	Type	Detector[1]
Control Room in MDB	FEM system	P
Toxic Cubicle in MDB	Dry chemical system complete with propellant nitrogen cylinders	P and T
Unpack Area in MDB	Preaction, dry pipe sprinkler system	T
ECRs in MDB	Preprimed high-speed deluge system	UV
CHB	Preaction dry pipe water fusible link melt sprinkler system	T

[1] P = photoelectric smoke; T = fixed-temperature and rate-of-rise thermal; UV = ultraviolet flame

INFORMATION SHEET 3-6-1 (Continued)
FIRE DETECTION & PROTECTION

FIRE DETECTION AND ALARM SYSTEM

Fires are detected by four types of fire detectors that are installed throughout the plant:

- Photoelectric smoke detectors
- Combination fixed-temperature and rate-of-rise thermal detectors
- Ionization smoke detectors
- Ultraviolet flame detectors

A fire detected by the fire detectors activates an alarm on the local fire alarm control panel. An alarm signal is sent to the main supervisory fire alarm panel (FPE-PANL-100) located in the control room. FPE-PANL-100 notifies the central control system at PLC ICS-CONR-102 and the Entry Control Facility main fire alarm annunciator panel of the event. The fire department is notified via a radio transmitter located in the Personnel Maintenance Building through a signal from the main supervisory fire alarm panel (FPE-PANL-100).An overview of the system is shown in Figure 3-20.

The detectors in the furnace rooms are a high-temperature, combination, fixed-temperature, and rate-of-rise type. Ultraviolet (UV) detectors serve as the fire detection system for the supervised high-speed deluge system installed in each Explosive Containment Room. All other areas are provided with smoke detectors or a combination of smoke and thermal detectors.

Rooms with FEM protection use cross-zoned photoelectric detectors. Rooms with a dry chemical extinguishing system protection also use cross-zoned protection with photoelectric detectors (TOX). On detection of a fire, a signal is sent to a fire-extinguishing panel (FEM or dry chemical) to activate the local audible and visual alarms simultaneously and annunciate in the control room. The main supervisory fire alarm panel in the control room indicates the exact area in which the fire has been detected, whereas the main fire alarm annunciator panel in the Entry Control Facility indicates only that a fire has been detected. The fire department receives an alarm signal through a radio transmission sent from the main supervisory fire alarm panel by way of a radio transmitter located in the Personnel Maintenance Building.

INFORMATION SHEET 3-6-1 (Continued)
FIRE DETECTION & PROTECTION

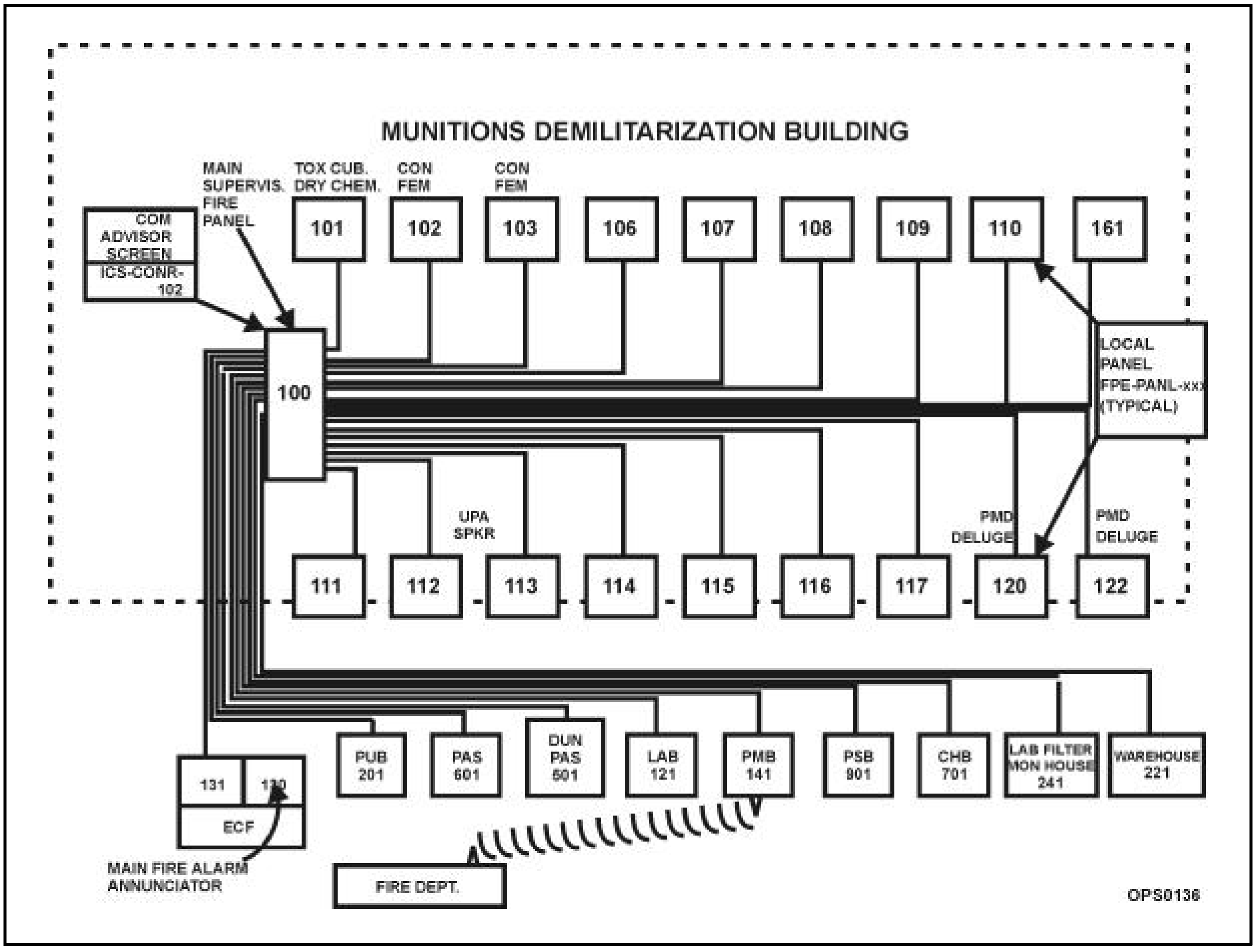

Figure 3-20 Fire Alarm System

INFORMATION SHEET 3-6-1 (Continued)
FIRE DETECTION & PROTECTION

AUTOMATIC SPRINKLER SYSTEM

Preaction-type, hydraulically designed, automatic sprinkler systems are located in the CHB and the UPA of the MDB. These systems are triggered automatically by thermal fire detectors in these areas. Because the UPA temporarily stores combustible materials and explosives, it is provided with an automatic sprinkler system to mitigate the fire hazard.

In the event of a fire, the sprinkler system dry pipes are charged with water by the activation of a deluge valve triggered by thermal detectors in the area. Sprinkler heads over the fire are activated thermally by melting a fusible link. Water is released through open sprinkler heads to extinguish the fire. If the fire is very small and remotely located from explosives, it could be fought effectively with a hand-held extinguisher. In the event of a large fire or if fire is detected in the CHB or UPA, the sprinkler system activates automatically. If the sprinkler system fails to start automatically, operators in the UPA and the CHB must activate the sprinkler system deluge valve manually.

FIRE EXTINGUISHING MEDIUM (FEM) SYSTEM

The automatic total flooding FEM system protects the control room areas. The FEM system is used to extinguish fires in these rooms because it does not damage electrical equipment. The control room areas have a raised computer room floor, which is also protected by its associated FEM system. The system is actuated by cross-zoned, photoelectric smoke detection that has a two-stage function: prealarm, and then discharge. When a detector in one zone of the rooms is activated, a warning alarm is indicated. The automatic FEM system is actuated only when the second detection is activated by a different zone. Activation occurs by the tripping of a second alarm, which sets the system into a time-delay mode. The time delay allows the Control Room Operators to activate an abort switch located in the control room. In addition, the delay allows evacuation of all affected personnel from the fire area, if necessary.

INFORMATION SHEET 3-6-1 (Continued)
FIRE DETECTION & PROTECTION

DRY CHEMICAL SYSTEM

Toxic Cubicle

An automatic, total-flooding, dry chemical system protects the TOX in the MDB. The dry chemical system uses nitrogen gas for pressurization. The system is actuated by a cross-zoned photoelectric smoke detector and combined fixed-temperature and rate-of-rise thermal detectors. Each system has a two-stage function: prealarm, and then discharge. When a detector in one zone of the area under protection is activated, a warning alarm is indicated. The automatic dry chemical system is actuated only when the second detector in a different zone is activated.

Activation occurs by the tripping of a second alarm, which sets the system into a time delay mode. The time delay allows for time to warn the personnel of the impending system discharge. The manual discharge station overrides the time delay and is all that is required to bring about the full operation of the system.

HIGH-SPEED DELUGE SYSTEM

An automatic, supervised, preprimed high-speed deluge fire-extinguishing system protects equipment in the Explosive Containment Rooms in the MDB. The system response time from detection to actuation is within 100 milliseconds. Each system operates independently. The extinguishing medium is water.

On fire detection by the UV detector or actuation of the manual pull station, the following sequence of events is initiated:

- Activate audible and visual alarm in the concerned ECR.
- Instantly discharge water over the protected area.
- Provide remote annunciation in the main supervisory fire panel.

INFORMATION SHEET 3-6-1 (Continued)
FIRE DETECTION & PROTECTION

3. PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers are wall mounted throughout the facilities and are used in the event of a small fire that has been determined to be one that can be handled safely and kept under control. Two types of portable fire extinguishers are available depending on the type of fire expected in the immediate area: carbon dioxide and multipurpose dry chemical. Portable fire extinguishers are used only in their designated areas.

Carbon dioxide fire extinguishers are placed in areas where electrical fires or electrical hazards are expected. The contents of these extinguishers are stored as a liquid under pressure and are expelled as a gas.

In areas where electrical fires or electrical hazards are not expected, multipurpose dry chemical fire extinguishers are sufficient.

OUTLINE SHEET 3-7-1
BULK INDUSTRIAL CHEMICAL STORAGE

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-7-1 “Bulk Industrial Chemical Storage”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Sodium Hydroxide Equipment.
   - 1.1 **STATE** the uses for 18% sodium hydroxide.
   - 1.2 Given a block diagram, **LABEL** the major components of the Sodium Hydroxide Equipment.
2. **DESCRIBE** the Sodium Hypochlorite Equipment.
   - 2.1 **STATE** the uses for 12% sodium hypochlorite.
   - 2.2 Given a block diagram, **LABEL** the major components of the Sodium Hypochlorite Equipment.

C. OUTLINE OF LESSON CONTENT

1. Sodium Hydroxide Equipment
   - a. System Overview
   - b. Process Description/Major Components
     - (1) Sodium Hydroxide Unloading Pump
     - (2) Sodium Hydroxide Storage Tank
     - (3) Sodium Hydroxide Supply Pump

OUTLINE SHEET 3-7-1 (Continued)
BULK INDUSTRIAL CHEMICAL STORAGE

2. Sodium Hypochlorite Equipment

   a. System Overview

   b. Process Description/Major Components

      (1) Sodium Hypochlorite Unloading Pump

      (2) Sodium Hypochlorite Storage Tank

      (3) Sodium Hypochlorite Transfer Pump

INFORMATION SHEET 3-7-1
BULK INDUSTRIAL CHEMICAL STORAGE

A. INTRODUCTION

The bulk chemical storage system provides concentrated chemical solutions from which the decontamination and neutralization solutions are made. The bulk industrial chemicals are sodium hydroxide (18%) and sodium hypochlorite (12%).

B. REFERENCES

1. ANCDF Functional Analysis Workbook

2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. SODIUM HYDROXIDE EQUIPMENT

SYSTEM OVERVIEW

The sodium hydroxide equipment is designed to unload Sodium Hydroxide (NaOH) from tanker trucks, store the contents of the truck, and distribute the sodium hydroxide to various locations as needed. Sodium Hydroxide at 18% weight is provided for the following:

- Wet pollution abatement system for pH control
- Utility station next to the Brine Reduction Area surge tanks
- Decon supply tanks to prepare decon solutions (for GB operations)
- Spent decon tanks to neutralize small amounts of agent.

INFORMATION SHEET 3-7-1 (Continued)
BULK INDUSTRIAL CHEMICAL STORAGE

PROCESS DESCRIPTION/MAJOR COMPONENTS

Sodium Hydroxide Unloading Pump

The unloading pump transfers sodium hydroxide from a tanker truck to one of the storage tanks.

Sodium Hydroxide Storage Tank

The storage tank provides storage capacity to maintain a constant supply of caustic for various plant operations. There are three storage tanks (some sites have only two tanks) used for storing Sodium Hydroxide. The tanks are fabricated of carbon steel.

Sodium Hydroxide Supply Pump

The supply pump recirculates the contents of the storage tank, and distributes sodium hydroxide to the plant users as needed. A portion of the NaOH is recycled back to the in-service tank through a pressure control and tank isolation valve. The pumps have both local and remote control and operate with one pump on line and one pump as a spare. Figure 3-21 shows the sodium hydroxide equipment.

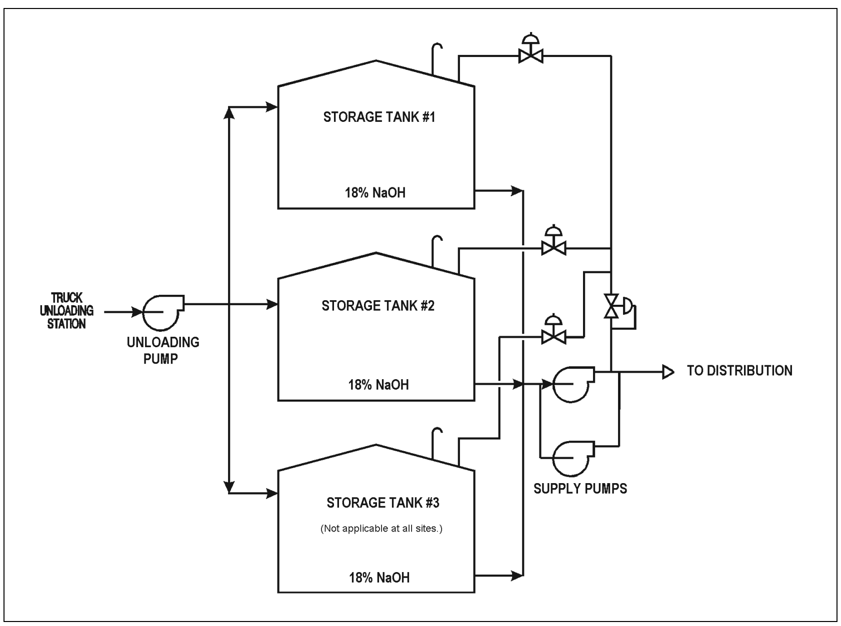

Figure 3-21: Sodium Hydroxide Equipment

INFORMATION SHEET 3-7-1 (Continued)
BULK INDUSTRIAL CHEMICAL STORAGE

2. SODIUM HYPOCHLORITE COMPONENTS

SYSTEM OVERVIEW

The Sodium Hypochlorite Equipment (Figure 3-22) is designed to unload Sodium Hypochlorite (NaOCl) from tanker trucks, store the truck's contents, and transfer NaOCl to the Central Decon Supply System as needed. Sodium Hypochlorite (12% concentration) is provided to the Central Decon Supply System (CDS) to be mixed into a 5.5% decon solution for decontaminating equipment and suited personnel during VX, HD, and HT operations.

PROCESS DESCRIPTION/MAJOR COMPONENTS

Sodium Hypochlorite Unloading Pump

The unloading pump transfers the concentrated Sodium Hypochlorite from a tanker truck to the bulk storage tank.

Sodium Hypochlorite Storage Tank

The storage tank provides the storage capacity to maintain a continuous supply of Sodium Hypochlorite to the CDS System. The tank is fabricated of fiber reinforced plastic.

Sodium Hypochlorite Transfer Pump

Sodium Hypochlorite is transferred to the CDS from the storage tank by a transfer pump.

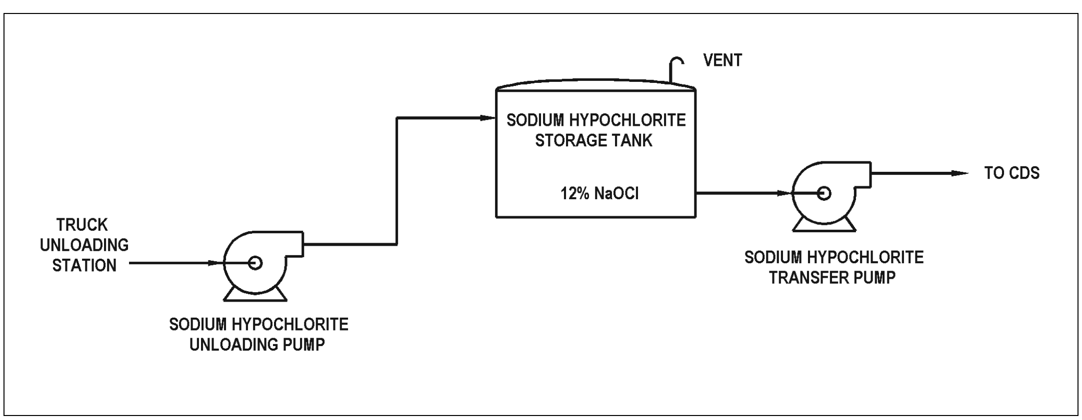

Figure 3-22: Sodium Hypochlorite Equipment

OUTLINE SHEET 3-8-1
CENTRAL DECON SUPPLY SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-8-1 “Central Decon Supply System”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Central Decon Supply System.

    1.1 **IDENTIFY** the purpose of the Central Decon Supply System.

    1.2 Given a block diagram, **LABEL** the major components of the Central Decon Supply System.

    1.3 **IDENTIFY** which decon solution is used for the following campaigns:

    - VX
    - GB
    - HD
    - HT

C. OUTLINE OF LESSON CONTENT

1. System Overview

    a. Major Components

        (1) Decon Supply Tanks

        (2) Decon Circulation Pump

        (3) Decon Supply Pump

        (4) Distribution Piping

        (5) Decon Head Tanks

INFORMATION SHEET 3-8-1
CENTRAL DECON SUPPLY SYSTEM

A. INTRODUCTION

This information sheet provides a functional overview of the Central Decon Supply System. Included is the process description and major components of the system.

B. REFERENCES

1. ANCDF Functional Analysis Workbook

2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The Central Decon Supply System (Figure 3-23) provides decontamination solutions to the demilitarization facility. Solutions are prepared and stored in the central decon supply tanks and are distributed throughout the facility by the central decon supply system pumps and piping system.

The Central Decon Supply System receives concentrated decon solutions [18% sodium hydroxide (NaOH) and 12 % sodium hypochlorite(NaOCl)] and dilutes them to the working concentration level by mixing them with process water. The system receives the NaOH and NaOCl from the bulk chemical storage tanks. After a batch of decon is mixed, it is piped throughout the facility for use.

The Munitions Demilitarization Building (MDB) is equipped with showers and hose stations for the routine decontamination of equipment and suited personnel.

INFORMATION SHEET 3-8-1 (Continued)
CENTRAL DECON SUPPLY SYSTEM

MAJOR COMPONENTS

Decon Supply Tanks

Decontamination solution is mixed, stored, and supplied from the supply tanks to the decon stations. Supply tanks are fabricated of fiber reinforced plastic, and have a storage capacity of 5,000 gallons each. Each decon supply tank is sized to provide sufficient decon for one week of operations.

The supply tanks supply 5½% Sodium Hypochlorite during VX and mustard (HD and HT) operations, or 1% Sodium Hydroxide during GB operations.

Decon Circulation Pump

The decon solution in the storage tanks is circulated during mixing and at any given time the Control Room determines it to be necessary. The circulation pumps circulate the contents of the supply tanks to ensure proper mixture of the decon solution. The pumps automatically shut down upon detection of low-low storage tank level and pump low discharge pressure.

Decon Supply Pump

The decon solution in the storage tanks is supplied to the CDS distribution, as needed, by the decon supply pumps. The supply pumps operate with one pump on line and the other pump in the standby position. The supply pumps automatically shut down on low-low storage tank level, pump low discharge pressure, and low gland seal water flow.

Distribution Piping

Decon solution is supplied to all decon stations through a network of distribution piping. The decon solution is used to decontaminate personnel in Demilitarization Protective Ensemble (DPE) suits, equipment, and areas where there have been toxic spills.

INFORMATION SHEET 3-8-1 (Continued)
CENTRAL DECON SUPPLY SYSTEM

Decon Head Tanks

Decon head tanks are provided in airlocks throughout the MDB for DPE decon operations. The tanks are initially pressurized to 25 psig with plant air and are maintained at this pressure by a pressure regulator.

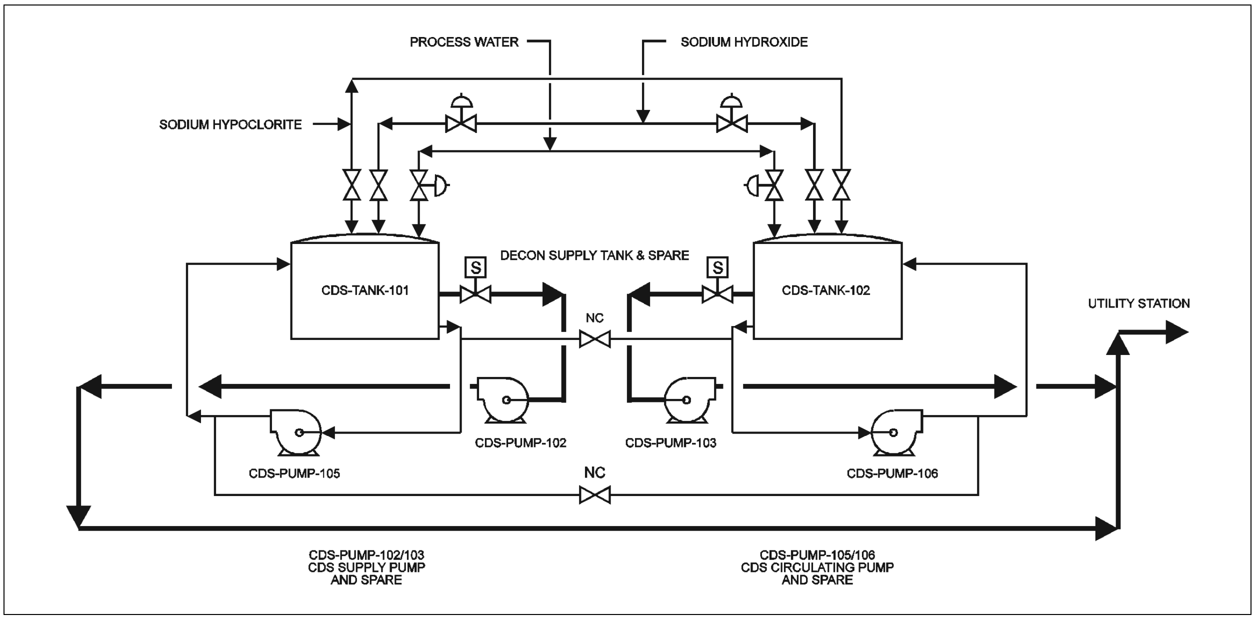

Figure 3-23: Central Decon Supply System

OUTLINE SHEET 3-9-1
COOLING WATER SYSTEMS

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-9-1 “Cooling Systems”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Primary Cooling Water System.

   1.1 **IDENTIFY** the purpose of the Primary Cooling Water System.

   1.2 **IDENTIFY** the components which are cooled by the Primary Cooling Water System.

   1.3 **IDENTIFY** the major components of the Primary Cooling Water System.

2. **DESCRIBE** the Secondary Cooling Water Systems.

   2.1 **IDENTIFY** the two systems that make up the Secondary Cooling Water Systems.

   2.2 **IDENTIFY** the major components of the Secondary Cooling Water Systems.

C. OUTLINE OF LESSON CONTENT

1. Primary Cooling System

   a. System Overview

   b. Major Components

      (1) Primary Cooling Medium Air Cooler

      (2) Primary Cooling Medium Circulation Pumps

      (3) Primary Cooling Medium Expansion Tank

      (4) Primary Cooling Medium Air Separator

OUTLINE SHEET 3-9-1 (Continued)
COOLING WATER SYSTEMS

2. Secondary Cooling Systems

   a. System Overview

   b. Major Components

      (1) Secondary Cooling Water Heat Exchangers

      (2) Secondary Cooling Pumps

      (3) Secondary Cooling Expansion Tanks

      (4) Secondary Cooling Water Air Separators

INFORMATION SHEET 3-9-1
COOLING WATER SYSTEMS

A. INTRODUCTION

This sheet provides information about the water cooling systems used within the Munitions Demilitarization Building. These systems include the Primary Cooling System, Metal Parts Furnace Secondary Cooling System, and the Hydraulic/DFS Lube Oil Secondary Cooling System.

B. REFERENCES

1. ANCDF Functional Analysis Workbook

2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. PRIMARY COOLING SYSTEM

SYSTEM OVERVIEW

The primary cooling water system (Figure 3-24) provides cooling for various systems in the Munitions Demilitarization Building (MDB). It is a closed-loop cooling system that uses an outdoor air-cooled heat exchanger to distribute a 50% glycol-water primary cooling medium.

The primary cooling water system provides cooling for the following:

- Plant Air Compressors
- Instrument Air Compressors
- Life Support Air Compressors
- Metal Parts Furnace Secondary Cooling Water Heat Exchanger
- Liquid Incinerator Slag Removal System Slide Gate*
- Hydraulic Module Secondary Cooling Water System Heat Exchanger*

**Not applicable at all sites.*

INFORMATION SHEET 3-9-1 (Continued)
COOLING WATER SYSTEMS

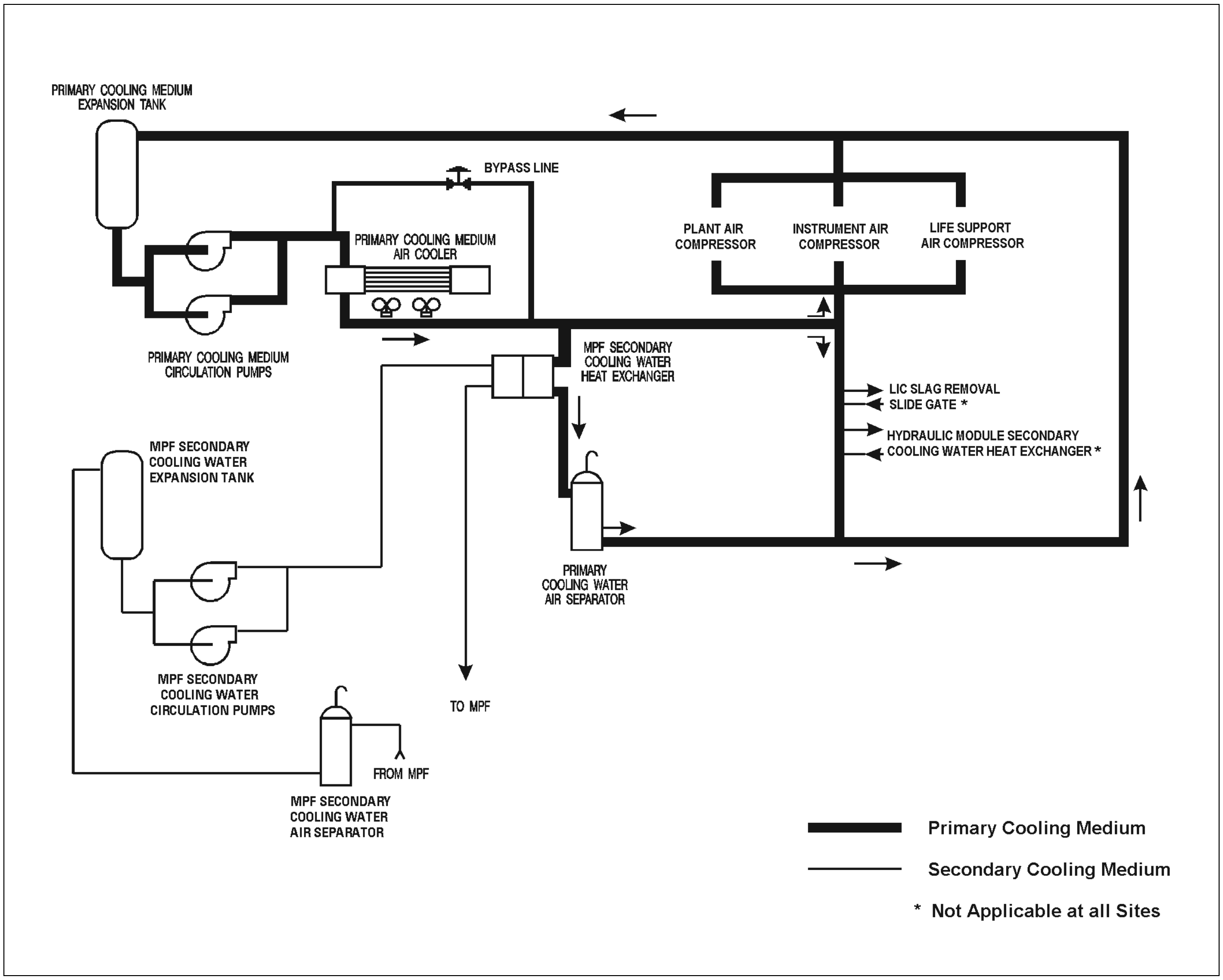

Figure 3-24: Primary Cooling / MPF Secondary Cooling Systems

MAJOR COMPONENTS

Primary Cooling Medium Air Cooler

The Primary Cooling Medium Air Cooler removes heat from the Primary Cooling Medium and transfers it to the atmosphere. This is a horizontal two pass heat exchanger. This large capacity heat exchanger is the ultimate heat sink for components. It has a bypass line installed to divert primary cooling medium fluid around the heat exchanger to maintain the liquid exiting the cooler at a constant temperature.

INFORMATION SHEET 3-9-1 (Continued)
COOLING WATER SYSTEMS

Two electric motor driven fans are used to force air over the heat exchanger that cools the primary cooling medium. A pneumatically operated louver arrangement is installed to make coarse adjustments in the amount of air flow over the heat exchanger.

Primary Cooling Medium Circulation Pumps

The primary cooling system uses two similar pumps to circulate primary cooling medium from the heat exchanger to the components cooled by Primary Cooling Medium. The pumps are installed in parallel to allow them to be operated in a run/standby manner. The primary cooling system circulation pumps have controls installed to allow operation locally or from the Control Room.

Primary Cooling Medium Expansion Tank

The Primary Cooling Medium Expansion Tank provides the following:

- Surge volume needed for expansion and contraction of the cooling medium

- Proper pump head to prevent pump damage due to cavitation

The primary cooling medium expansion tank is located above the circulating pumps providing suction pressure from water height. As long as the level is maintained in the tank, pump cavitation will not be a problem.

Primary Cooling Medium Air Separator

Air can be entrained into the primary cooling medium from leaks located in low pressure areas or added with makeup water. Air in the system can cause damage from water hammer, affecting piping and components, or damage to the pumps from cavitation. Air is stripped out of the primary cooling medium by an air separator installed on the return line from the Metal Parts Furnace door cooling water heat exchanger. The primary cooling medium air separator is installed at the highest point in the system to allow air to easily reach it. This allows air to be easily vented out of the system.

INFORMATION SHEET 3-9-1 (Continued)
COOLING WATER SYSTEMS

2. SECONDARY COOLING SYSTEMS

SYSTEM OVERVIEW

The secondary cooling systems consist of two separate systems. One loop is dedicated to the Metal Parts Furnace Exit Door Cooling while the other supplies the Hydraulic Module Heat Exchanger(s) and the Deactivation Furnace Lube Oil System. The MPF Secondary Cooling System is shown with the primary cooling system in Figure 3-24. The Hydraulic Secondary Cooling System is shown in Figure 3-25. Each loop consists of:

- Secondary Cooling Water Heat Exchanger(s)
- Secondary Cooling Water Circulating Pumps
- Secondary Cooling Water Expansion Tank
- Secondary Cooling Water Air Separator

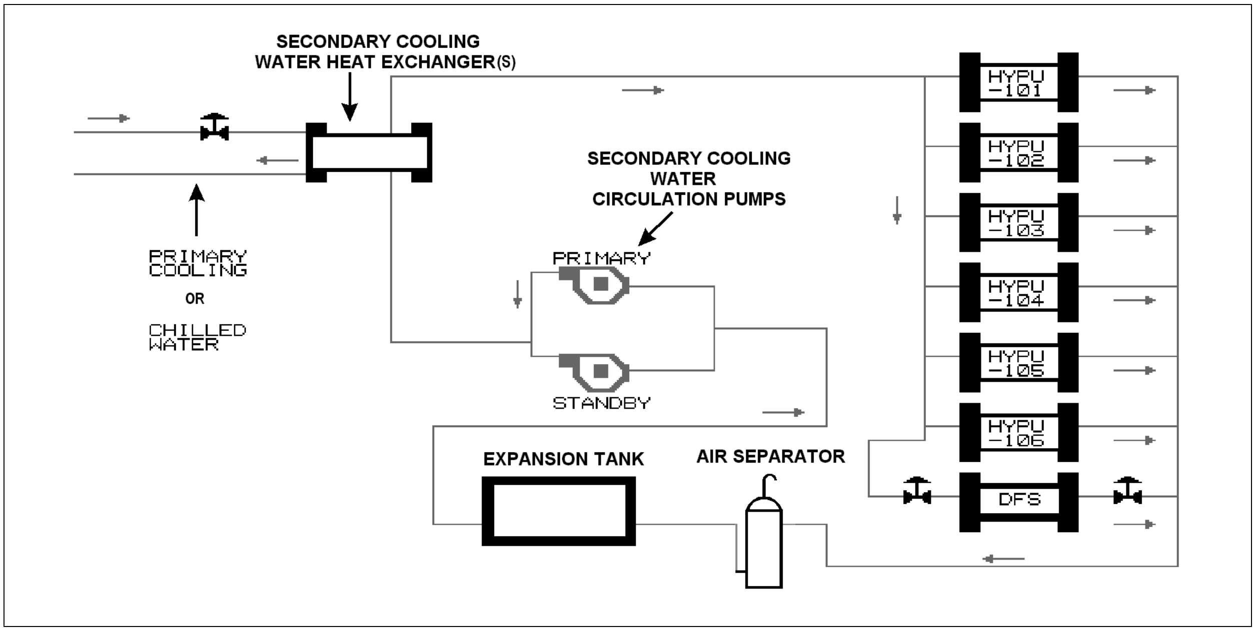

Figure 3-25: Hydraulic Module Secondary Cooling System

INFORMATION SHEET 3-9-1 (Continued)
COOLING WATER SYSTEMS

MAJOR COMPONENTS

Secondary Cooling Water Heat Exchanger(s)

The Metal Parts Furnace Secondary Cooling Water loop has only one heat exchanger installed. The Metal Parts Furnace Secondary Cooling Water Heat Exchanger transfers heat from Secondary Cooling Water, picked up from the Metal Parts Furnace discharge door, to the primary cooling medium. This heat exchanger is designed to supply Secondary Cooling Water at approximately 100°F during Metal Parts Furnace operation.

The Hydraulic Module Secondary Water Heat Exchanger(s) removes the heat picked up by the Secondary Cooling Water from the Hydraulic Module Heat Exchangers and the DFS Lube Oil System. At some sites heat is transferred to the primary cooling medium. At other sites it is transferred to chilled water supplied by an air-cooled chiller.

Secondary Cooling Pumps

Each secondary cooling system consists of two cooling water circulating pumps to transfer secondary cooling water between loads and heat exchanger(s). Metal Parts Furnace Secondary Cooling Water Circulation Pumps have the same type controls and operational features as the Primary Cooling Medium Pumps. The Hydraulic Module Secondary Cooling Water Circulation Pumps are similar to the Metal Parts Furnace loop pumps but are rated for a slightly higher flow.

Secondary Cooling Expansion Tanks

The secondary cooling water expansion tanks are similar in construction and operation. They provide surge volumes and proper suction pressures for their respective loops.

Secondary Cooling Water Air Separators

The secondary cooling water air separators remove entrained air from the Secondary Cooling Water systems to prevent equipment damage.

OUTLINE SHEET 3-10-1
HYDRAULIC SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 3-10-1 "Hydraulic Systems".

B. LESSON OBJECTIVES

1. **DESCRIBE** the Hydraulic System.

   1.1 **IDENTIFY** the purpose of the Hydraulic System.

   1.2 **IDENTIFY** the major components of the Hydraulic System.

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Major Components

   a. Hydraulic Power Unit

      (1) Hydraulic Pump

      (2) Hydraulic Fluid Reservoir

      (3) Accumulator

   b. Hydraulic Valve Manifolds

INFORMATION SHEET 3-10-1
HYDRAULIC SYSTEM

A. INTRODUCTION

This sheet provides information of the Hydraulic System. Included is a system overview and descriptions of the major components.

B. REFERENCES

1. ANCDF Functional Analysis Workbook
2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The hydraulic power system supplies power to the hydraulically operated equipment in the munitions demilitarization building (MDB). The hydraulic power system consists of six hydraulic power units, hydraulic control valve manifolds, and hydraulic module secondary cooling water equipment.

The Hydraulic Power Units are arranged so that pairs of power units supply the same loads. This enables cross connecting power units and loads to maintain a source of hydraulic pressure in the event of a unit failure. Hydraulic Distribution is as follows:

- HYPU-101/102 Blast Gates, Blast Doors, Indexing Conveyors
- HYPU-103/104 Rocket Shear Machine / Burster Size Reduction, Mine Machine, Projectile/ Mortar Disassembly Machine
- HYPU-105/106 Multipurpose Demil Machine and Bulk Drain Station

Figures 3-26, 3-27, and 3-28 show the hydraulic valve manifolds and the loads they supply.

INFORMATION SHEET 3-10-1 (Continued)
HYDRAULIC SYSTEM

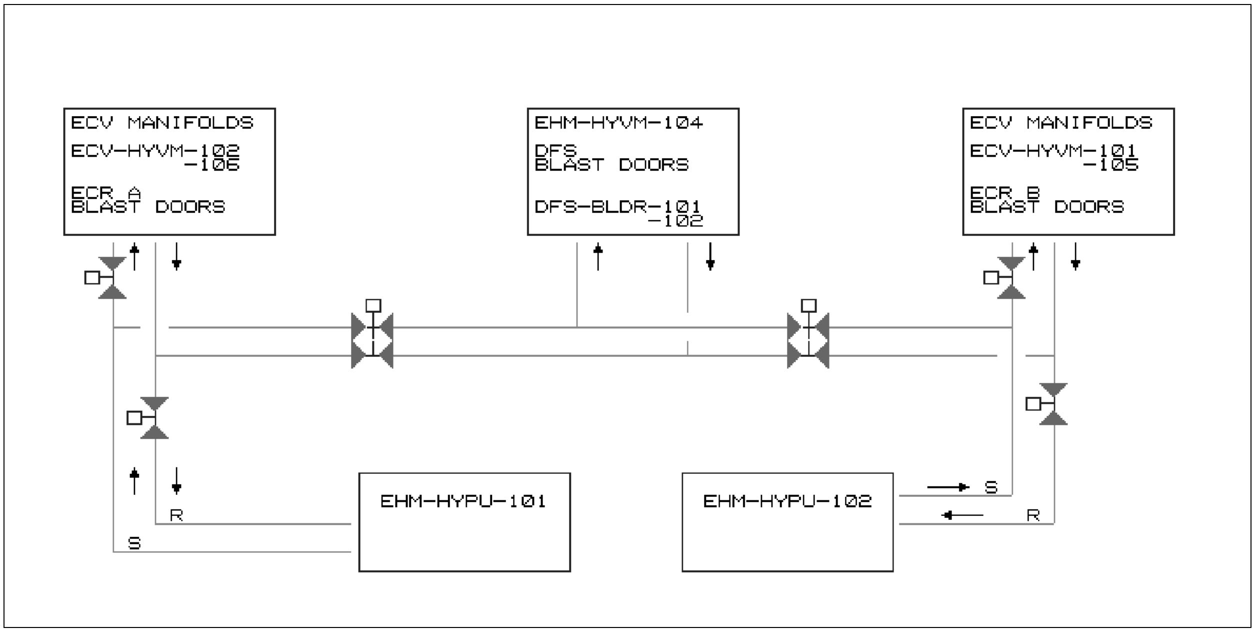

Figure 3-26: Hydraulic Valve Manifold 1

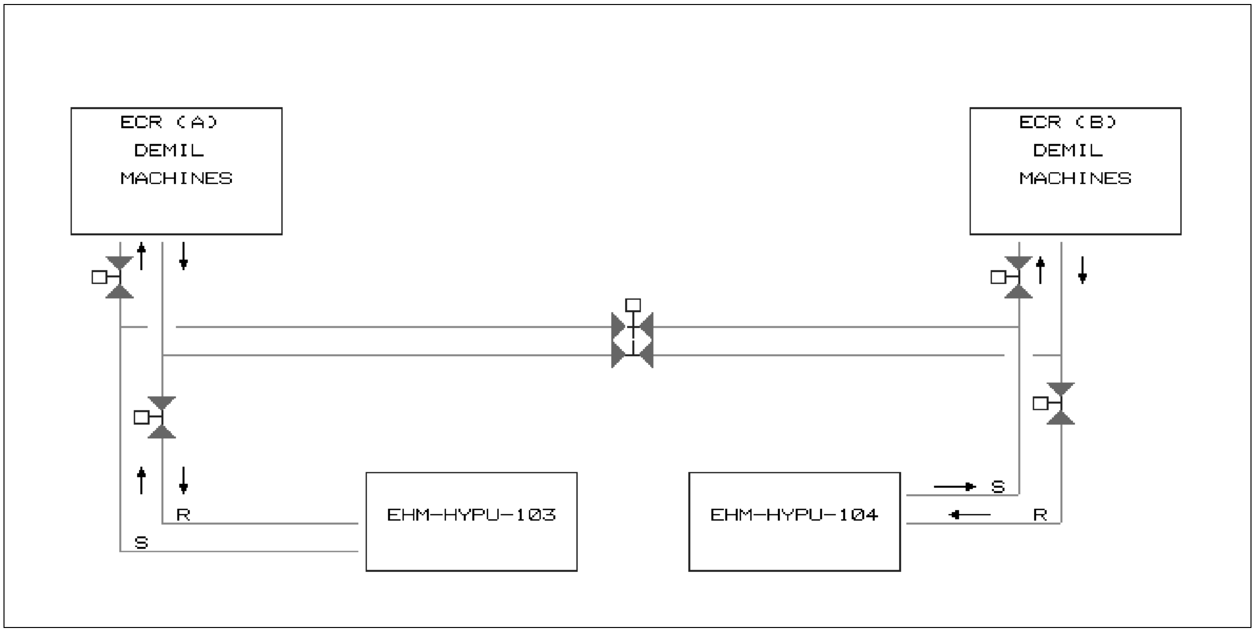

Figure 3-27: Hydraulic Valve Manifold 2

INFORMATION SHEET 3-10-1 (Continued)
HYDRAULIC SYSTEM

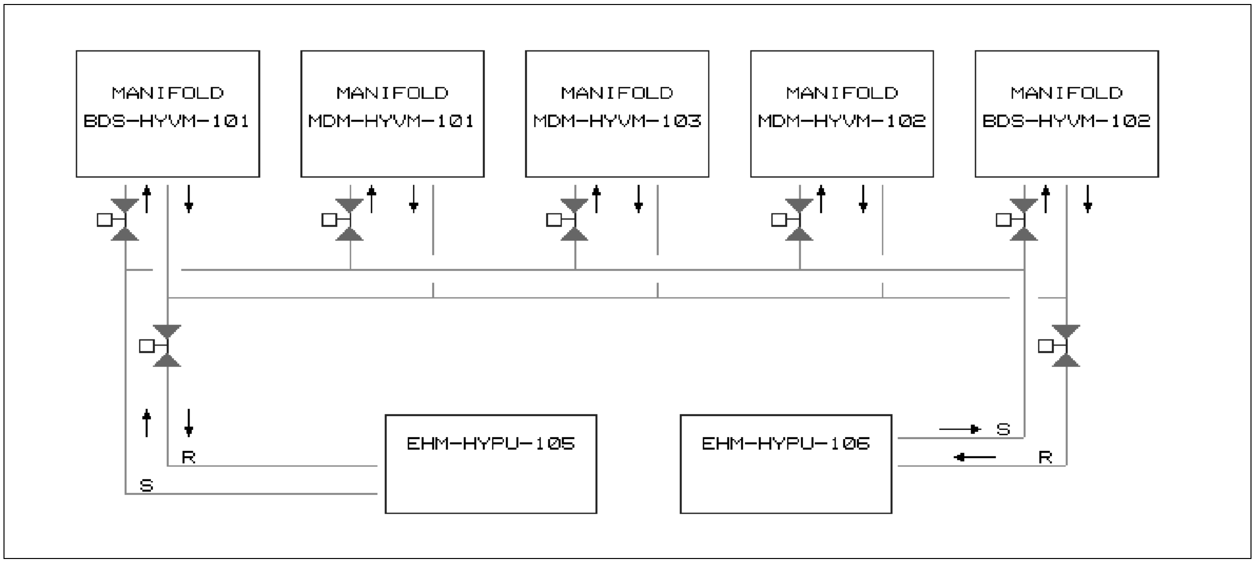

Figure 3-28: Hydraulic Valve Manifold 3

2. MAJOR COMPONENTS

HYDRAULIC POWER UNIT

All hydraulic power units are centrally located on the first floor of the MDB in the equipment hydraulic module. Each hydraulic power unit is composed of an hydraulic pump, a hydraulic fluid reservoir, and bladder-type accumulators. Figure 3-29 show a typical hydraulic power unit.

Hydraulic Pump

Each hydraulic pump is an electrically driven, axial-piston, variable displacement, pressure-compensated type that pressurizes hydraulic fluid to various pressures depending on the requirements.

INFORMATION SHEET 3-10-1 (Continued)
HYDRAULIC SYSTEM

Hydraulic Fluid Reservoir

The hydraulic fluid is stored in hydraulic fluid reservoirs that are sized differently depending on the hydraulic power unit. The hydraulic fluid is a water-glycol medium that is not flammable.

Circulating hydraulic fluid is cooled in a shell-and-tube-type heat exchanger. The hydraulic fluid is cooled by secondary cooling water. An electric motor-driven circulation pump is used to force hydraulic fluid through the exchanger.

Accumulator

Each power unit contains between one and five bladder-type accumulators. The accumulators are precharged with nitrogen gas. The accumulators satisfy the peak operating flow demand and are also used as a pulsation damper in the system.

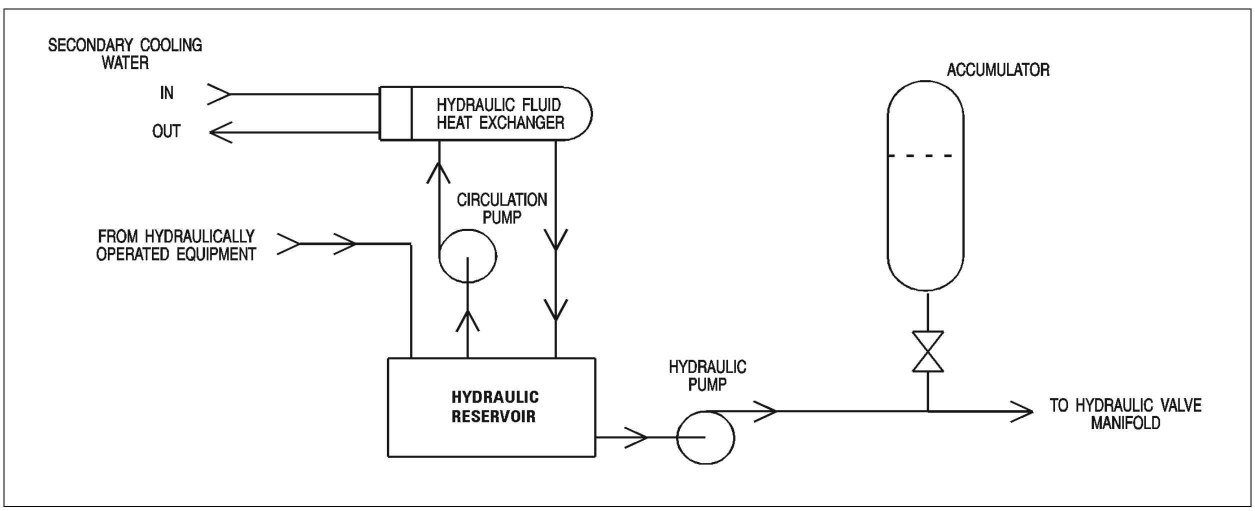

Figure 3-29: Hydraulic Power Unit

INFORMATION SHEET 3-10-1 (Continued)
HYDRAULIC SYSTEM

HYDRAULIC VALVE MANIFOLDS

The Hydraulic Valve Manifolds receive the high pressure hydraulic fluid from the Hydraulic Power Units and control the direction, pressure, and rate of the hydraulic fluid provided to individual hydraulic components. Each Hydraulic Valve Manifold contains electrically operated:

- Directional Control Valves
- Pressure Control Valves
- Flow Control Valves

The directional control valves control the direction of the hydraulic fluid. Each directional control valve is operated by electric solenoids. The solenoids can stop or change the direction of the hydraulic fluid based on whether it is energized or de-energized. The direction of the hydraulic fluid eventually determines the rotational direction of hydraulic motors (forward or reverse) or the direction of travel for linear actuators (extend or retract).

Pressure control valves control the amount of pressure or torque a hydraulic device can obtain.

Flow control valves control the speed of the hydraulic fluid which in turn controls the speed of hydraulic motors or linear actuators. Figure 3-30 shows a typical hydraulic circuit.

INFORMATION SHEET 3-10-1 (Continued)
HYDRAULIC SYSTEM

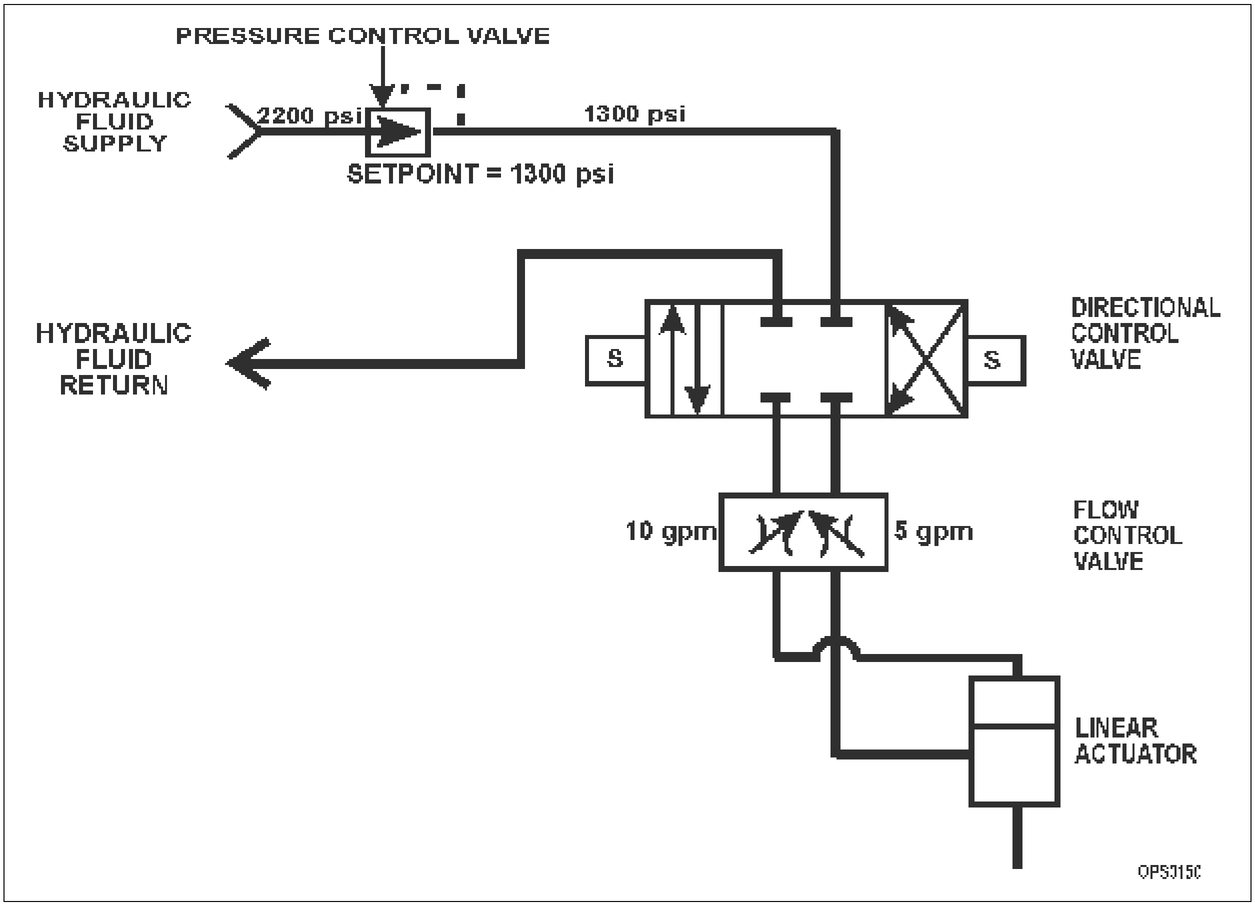

Figure 3-30: Typical Hydraulic Circuit

UNIT 4: DEMIL LINES

OUTLINE SHEET 4-1-1
ROCKET HANDLING SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 4-1-1 "Rocket Handling System".

B. LESSON OBJECTIVES

1. **DESCRIBE** the Rocket Handling System.

   1.1 **STATE** the purpose of the Rocket Handling System.

   1.2 **IDENTIFY** the function of the following major components of the Rocket Handling System.

   - Rocket Metering Input Assembly
   - Rocket/Mine Input Conveyor
   - Rocket Shear Machine
   - Agent Quantification System

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Process Description/Major Components

   a. Rocket Handling Equipment

      (1) Rocket Metering Input Assembly

      (2) Rocket/Mine Input Conveyor and Airlock Assembly

   b. Rocket Processing Equipment

      (1) Rocket Shear Machine

         (a) Rocket Drain Station

            1) Agent Quantification System

         (b) Rocket Shear Station

INFORMATION SHEET 4-1-1
ROCKET HANDLING SYSTEM

A. INTRODUCTION

This sheet provides information on the handling and processing of M55 rockets at a Chemical Agent Disposal Facility.

B. REFERENCES

1. Programmatic Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The rocket handling system (RHS) performs the handling and demilitarization processes of M-55 rockets. The rocket handling equipment transports fully assembled rockets (in their firing tubes as shown in Figure 4-1) from the unpack area, through the explosive containment vestibule, and into the explosive containment rooms (ECRs) where the rocket processing equipment is located. In the explosive containment rooms, rockets are demilitarized by removing the agent stored in the rocket body cavity and shearing the rocket into pieces. The sheared rocket pieces are fed in batches to the deactivation furnace system (DFS) for destruction. Drained agent is collected in the agent quantification system before being transferred to the agent collection tank in the toxic cubicle (TOX). Agent is fed from the agent collection tank to the liquid incinerator (LIC) system for destruction. Figure 4-2 show an illustration of the rocket process flowpath.

INFORMATION SHEET 4-1-1 (Continued)
ROCKET HANDLING SYSTEM

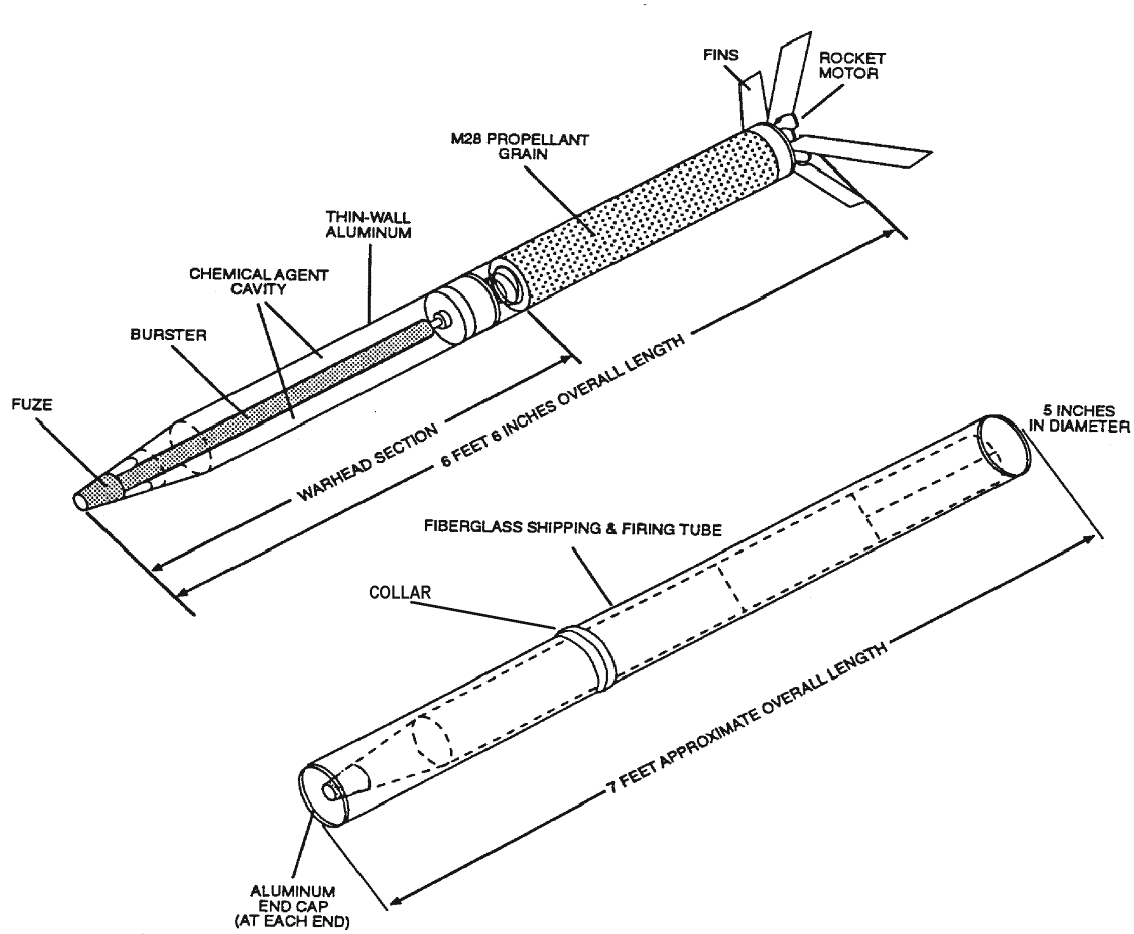

Figure 4-1: M55 Rocket and Shipping Tube

INFORMATION SHEET 4-1-1 (Continued)
ROCKET HANDLING SYSTEM

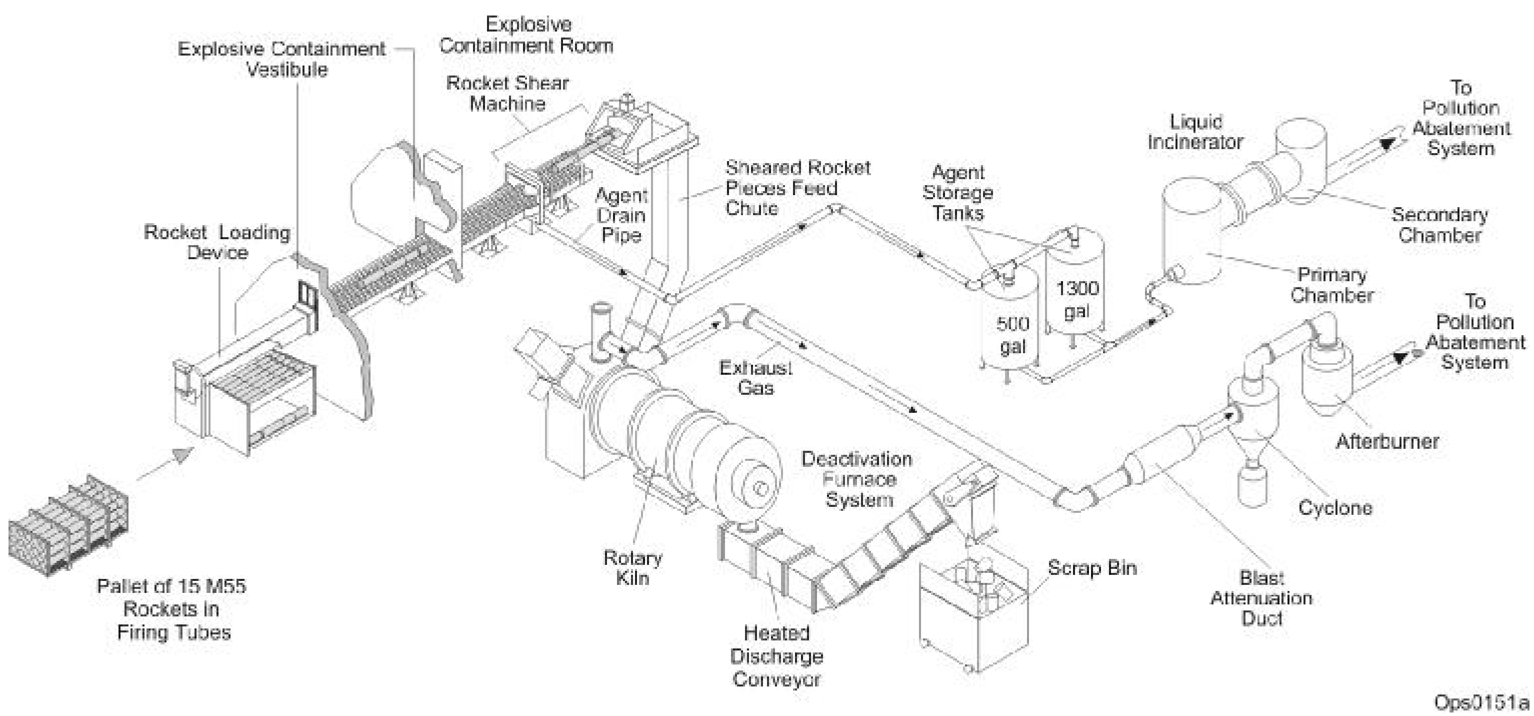

Figure 4-2: Rocket Processing Overview

INFORMATION SHEET 4-1-1 (Continued)
ROCKET HANDLING SYSTEM

2. PROCESS DESCRIPTION/MAJOR COMPONENTS

ROCKET HANDLING EQUIPMENT

The unpack area (UPA) operators manually load rockets into the rocket metering input assembly. The rocket metering input assembly consists of a feed table, rotating drum, and reject table. The rocket metering input assembly is integral with the rocket/mine input conveyor #1 and airlock assembly. Figure 4-3 shows the rear view of a rocket metering input assembly.

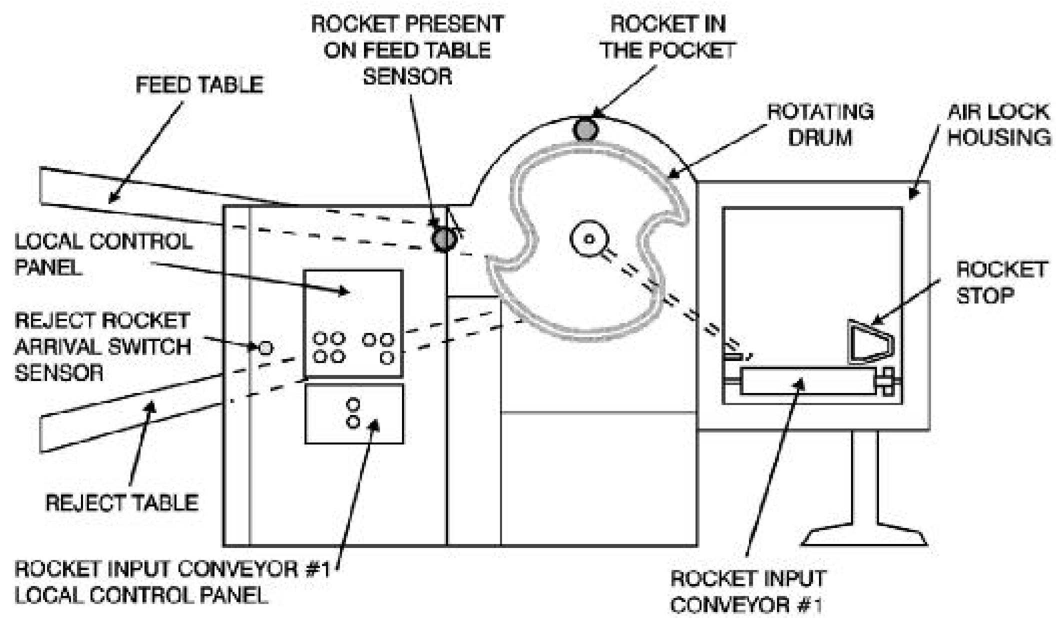

Figure 4-3: Rocket Metering Input Assembly (Rear View)

INFORMATION SHEET 4-1-1 (Continued)
ROCKET HANDLING SYSTEM

Rocket Metering Input Assembly

The rocket metering input assembly checks the rockets for correct orientation for processing. When a rocket is loaded, it moves by gravity to the load position next to the drum. A sensor detects the presence of a rocket in the feed position. This causes the PLC to check the orientation switch beneath the slot in the feed table.

The orientation switch is a lever-actuated limit-type switch that senses the collar on the rocket shipping tube. If the collar is detected, the rocket is flagged as oriented; otherwise, the rocket is flagged as misoriented. In either case the drum is then rotated clockwise (forward) to the home position. A slot in the drum rotates past the feed position allowing the rocket to roll into the slot. The rocket is then carried to the home position. In this position, the two slots in the drum are pointed straight up and down. With the drum at the home position and the drum slot full as detected by another sensor, the PLC rotates the drum either forward (clockwise) or reverse (counterclockwise), depending on the orientation switch status.

If the rocket is correctly oriented and no rockets are detected on either rocket/mine input conveyor #1 or #2, the drum is rotated forward. If a rocket is at the feed position on the feed table, it is loaded into the drum. The drum continues to rotate in forward until the PLC stops the drum at the home position, where the feed cycle is reset. The rocket that was originally in the slot is dropped onto rocket/mine input conveyor #1.

If the rocket is incorrectly oriented, the drum is rotated in reverse until the home position switch is tripped. The rocket falls out of the drum slot onto the reject table located below the feed table.

Rocket/Mine Input Conveyor and Airlock Assembly

Rocket/mine input conveyor #1 and airlock assembly is an integral part of the rocket metering input assembly. The conveyor receives rockets as they roll out of the metering drum and sends them forward to rocket/mine input conveyor #2 in the ECV. The rocket is then allowed to move into the Explosive Containment Room (ECR).

INFORMATION SHEET 4-1-1 (Continued)
ROCKET HANDLING SYSTEM

ROCKET PROCESSING EQUIPMENT

Rockets are processed in the ECR by the Rocket Shear Machine (RSM) (Figure 4-4). A maximum of two rockets can be processed by the RSM at any one time: one rocket is drained in the rocket drain station (RDS) while the other is sheared in the rocket shear station (RSS). The drained agent is measured and sent to the toxic storage area (TOX). Sheared rocket pieces are sent to the DFS.

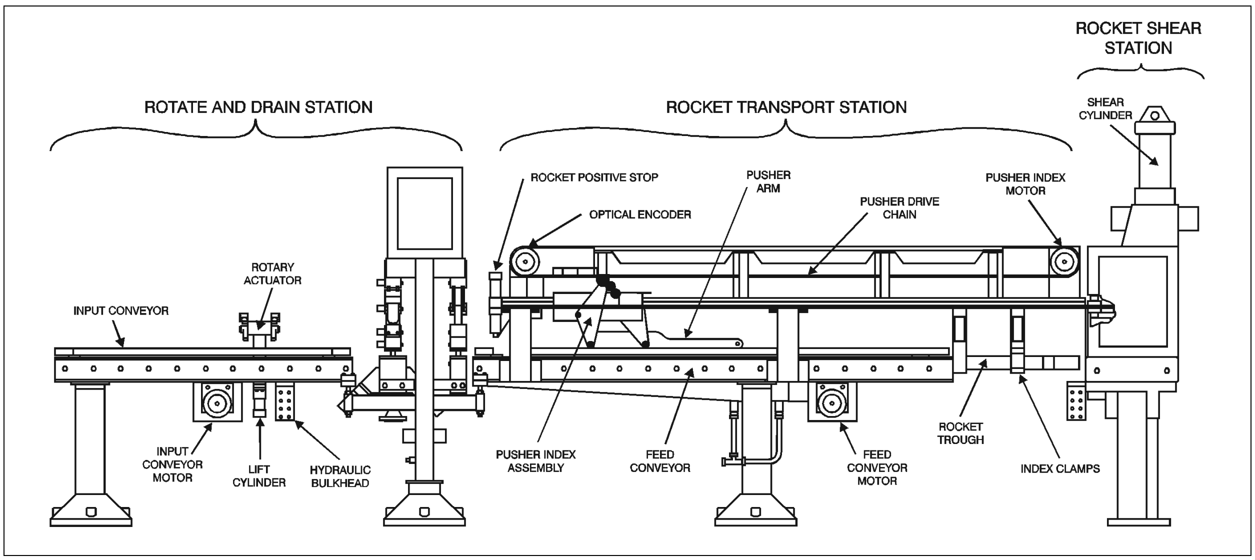

Figure 4-4: Rocket Shear Machine

INFORMATION SHEET 4-1-1 (Continued)
ROCKET HANDLING SYSTEM

Rocket Shear Machine

The rocket shear machine is divided into two major work stations: the rocket drain station and the rocket shear station.

Rocket Drain Station - Rockets are transported into the ECR by the rocket drain station input conveyor as they exit the ECV by rocket/mine input conveyor #2. After the rocket is in position, the ECV blast gate is closed, the rocket is clamped, the vent and punch cylinders are extended, and the rocket is punched with two drain holes and a vent hole. Agent is drained from the two drain holes and transferred to the agent quantification tank.

After the rocket has been drained and the amount collected has been verified, the clamps are retracted and the rocket is rotated 90° in the counterclockwise direction when looking at the tail end of the rocket. Rotating the rocket minimizes any residual agent from dripping out of the rocket while it is being transferred and sheared.

The rocket drain station input conveyor then starts forward and continues to run until the rocket clears the rocket drain station and is detected at the rocket shear station.

<u>**Agent Quantification System**</u> - Agent drained from the rocket agent cavity is measured by the Agent Quantification System (AQS) and the amount drained is recorded by the PLC. The PLC compares the measured agent level in the AQS tank against the nominal fill level for the M55 rocket. If the agent level measured in the AQS tank is 95% or more of the nominal level, the rocket is considered to have been sufficiently drained. Agent is drawn out of the AQS tank and sent to the toxic cubicle. If the agent level measured in the AQS is less than 95% of the nominal level, the control room operator may repeat the drain sequence.

Rocket Shear Station - The rocket shear station receives drained rockets from the rocket drain station and cuts the rocket into eight sections. The first cut (approximately 4.5 in. from the tip) separates the fuze from the rest of the body. This separation avoids creating an explosive combination within the DFS rotary kiln.

INFORMATION SHEET 4-1-1 (Continued)
ROCKET HANDLING SYSTEM

The first rocket of the day will have its fuze fed immediately onto the slide blast gate. The second through the fifth shear pieces are then cut and collected on the top DFS blast gate before they are fed into the DFS. The sixth and seventh pieces are again collected on the DFS blast gate and fed into the DFS together. The tail piece is then pushed on the blast gate where it awaits the fuze of the incoming rocket prior to feeding into the DFS. The following table shows the approximate cut lengths that were used for GB rocket shear processing at TOCDF.

Table 4.1 TOCDF Rocket Shear Machine Cut Lengths

Cut Length No.	Approximate Length (in)
1	4.5
2	8.80
3	8.95
4	10.04
5	11.875
6	11.875
7	9.76
8	16.20

The shear blade is cooled by a spray system which can use either water or decon. When processing GB rockets, decon is used, and for VX rocket processing, water is used. Cooling spray is supplied automatically using a solenoid valve in the water/decon line, which opens just before the shear blade extends and closes immediately after the shear blade retracts. This cooling water is required to prevent ignition of the rocket energetic material. The spray also rinses energetic and agent residue from the blade, lubricates the blade, and helps to control dust in the ECR.

OUTLINE SHEET 4-2-1
PROJECTILE HANDLING SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 4-2-1 “Projectile Handling System”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Projectile Handling System.

   1.1 **IDENTIFY** the purpose of the Projectile Handling System.

   1.2 **IDENTIFY** the function of the stations on the Projectile/Mortar Disassembly Machine.

   1.3 **IDENTIFY** the function of the stations on the Multi-purpose Demilitarization Machine.

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Process Description/Major Components

   a. Projectile/Mortar Disassembly Machine (PMD)

      (1) Station 1: Load Station

      (2) Station 2: Nose Closure Removal Station

      (3) Station 3: Miscellaneous Parts Removal Station

      (4) Station 4: Burster Removal Station

      (5) Station 5: Unload Station

   b. Projectile Tilting Conveyor

OUTLINE SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

c. Multiposition Loader (MPL)

d. Pick and Place Machine (PKPL)

e. Multipurpose Demilitarization Machine (MDM)

(1) Station 1: Load/Unload Station

(2) Station 4: Bore Station

(3) Station 5: Pull and Drain Station

(a) Agent Collection and Drain Verification System

(4) Station 6: Burster Well Crimp Station

3. Projectile/Mortar Reject Handling

a. Reject Handling at the PMD

b. Reject Handling at the MPL

c. Reject Handling at the MDM

INFORMATION SHEET 4-2-1
PROJECTILE HANDLING SYSTEM

A. INTRODUCTION

This sheet provides information on the handling and processing of Projectiles/Mortars at a Chemical Agent Disposal Facility.

B. REFERENCES

1. Programmatic Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The Projectile Handling System (PHS) removes and separates explosive components and agent from projectile and mortar bodies for processing in the specialized furnace systems. Figure 4-5 shows an overview of the projectile process.

The projectile handling system transports fully assembled projectiles from the unpack area to the projectile processing equipment in the explosive containment rooms (ECRs). In the ECRs, explosive components and miscellaneous parts are separated from the munitions by the projectile/mortar disassembly machines (PMDs) and delivered to the deactivation furnace system (DFS) for destruction. After explosive components are removed in the ECRs, the projectile/mortar bodies containing agent are transported to the munitions processing bay where the agent is drained by the multipurpose demilitarization machines (MDMs). Drained agent is collected in the toxic cubicle (TOX) before being destroyed in the liquid incinerator (LIC). The projectile/mortar bodies are transported to the metal parts furnace system (MPF) for thermal processing.

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

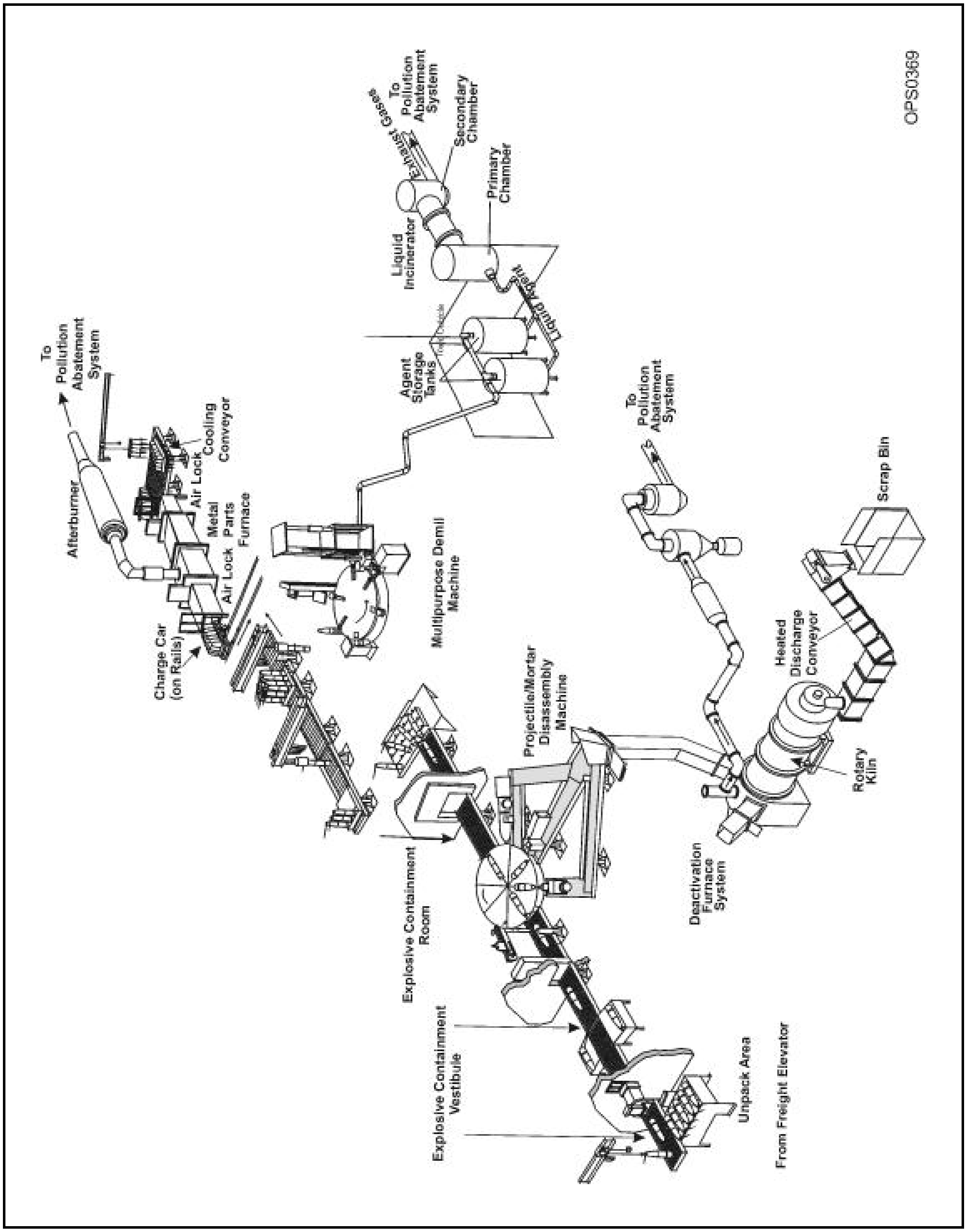

Figure 4-5: Projectile/Mortar Processing Overview

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

2. PROCESS DESCRIPTION/MAJOR COMPONENTS

The demilitarization process of projectiles/mortars starts by the unpack area (UPA) operator loading a munition, tail-end forward, onto the UPA projectile/mortar feed conveyor. If the munition is properly oriented, then it is moved forward into the explosive containment vestibule (ECV) through an airlock. The munition is then conveyed into the explosive containment room (ECR) to start the reverse assembly process performed by the projectile/mortar disassembly machine.

PROJECTILE/MORTAR DISASSEMBLY MACHINE (PMD)

The PMD is a multifunction machine designed to remove the explosive components from all agent-filled projectiles. It can accommodate all types of chemical projectiles in the U.S. stockpile. However, the machine has to be specifically set up for each projectile design. Figure 4-6 shows an aerial view of a PMD.

The PMD has five active workstations:

- Station 1: load station
- Station 2: nose closure removal station
- Station 3: miscellaneous parts removal station
- Station 4: burster removal station
- Station 5: unload station

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

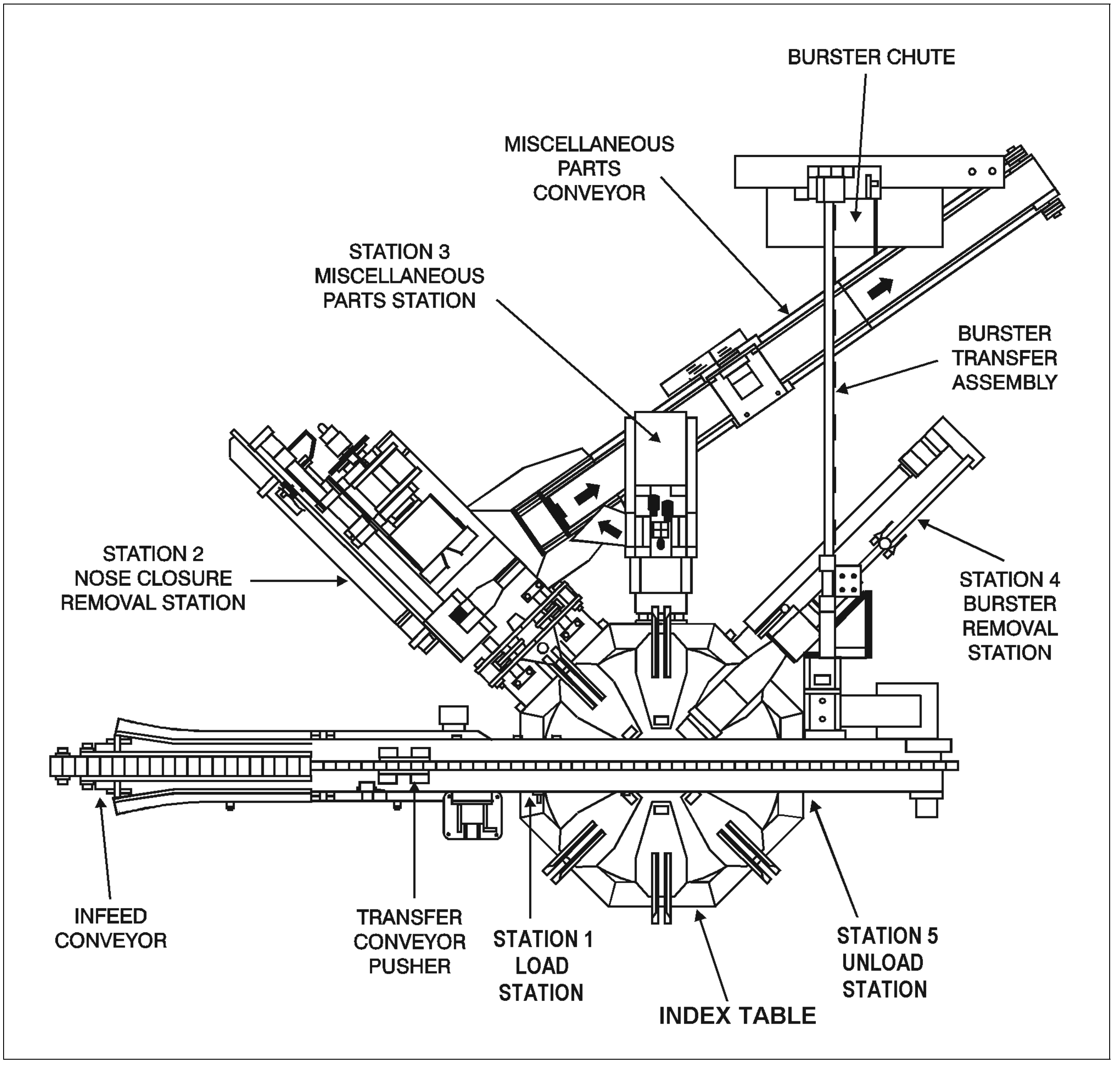

Figure 4-6: Projectile/Mortar Disassembly Machine

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

Station 1: Load Station

The infeed/transfer conveyor assembly pushes munitions onto the index table. The index table is a rotating platform with eight positions. It transports munitions from station to station within the machine during the disassembly process.

Station 2: Nose Closure Removal Station

The nose closure removal station removes the nose closure or fuze from projectiles and fuzes with burster from mortars. All components removed are dropped onto the miscellaneous parts conveyor which discharges onto the DFS feed gate. There are two different gripper assemblies currently being used. The NCRS Hydraulic Chuck and Gimbal Cam Socket (GCS). This addition of the GCS has made a tremendous improvement in the processing and cutting down on the number of rejects of certain munitions.

Station 3: Miscellaneous Parts Removal Station

The miscellaneous parts removal station removes the fuze well cup or supplementary charges from the projectiles. All components removed here are dropped onto the miscellaneous parts conveyor which discharges onto the DFS feed gate.

Station 4: Burster Removal Station

The burster removal station removes the bursters from the projectiles. The burster transfer assembly then transfers the removed burster to the burster size reduction station. The burster size reduction station is essentially the Rocket Shear Machine that has been reconfigured by installing a burster size reduction kit. Here the removed bursters are sheared and dropped onto the DFS feed gate.

Station 5: Unload Station

The infeed/transfer conveyor pushes processed munitions from the index table onto the discharge conveyor. The munition (which is now nose end forward) is transported out of the explosion containment room, through the blast gate, into the upper munitions corridor, and to the tilting conveyor.

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

PROJECTILE TILTING CONVEYOR

The projectile tilting conveyor (Figure 4-7) intersects the projectile output conveyor at a 90° angle. It then feeds the munition into the clamp and tilt assembly where it is oriented vertically on a pedestal.

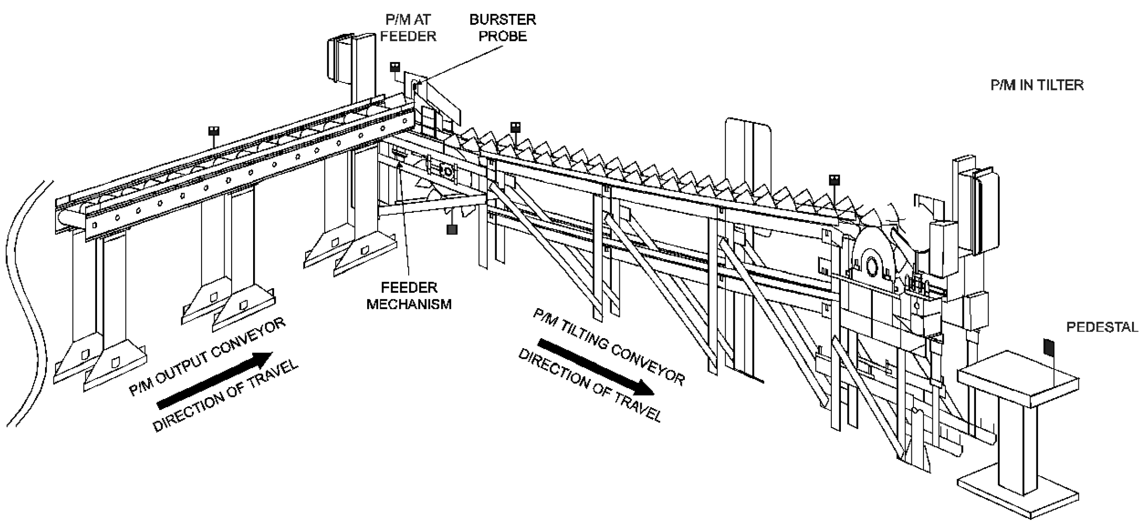

Figure 4-7: Projectile Tilting Conveyor

MULTIPOSITION LOADER (MPL)

The MPL picks up a munition from the pedestal and loads it into an empty position on an egg crate which sits on a tray on the bypass indexing hydraulic conveyor. The MPL then returns unloaded to its home position above the pedestal.

When the MPL finishes filling a tray, the disassembled munitions are ready to be transported for the next stage of the demil process which is agent removal. A munitions corridor charge car is used to pick up a loaded tray and transfer it to either the Buffer Storage Area for temporary storage or directly to the multipurpose demilitarization machine feed conveyor.

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

PICK AND PLACE MACHINE (PKPL)

The tray of projectiles/mortars is conveyed to the "pick and place machine" (PKPL). The pick and place machine is used to transfer the projectiles/mortars from the tray on the conveyors to the load/unload station of the MDM and to transfer the casings back onto the tray after the drain operations have been completed.

MULTIPURPOSE DEMILITARIZATION MACHINE (MDM)

The main function of the MDM is to pull the burster wells, drain the agent, and crimp the burster wells. Figure 4-8 shows an aerial view of a MDM.

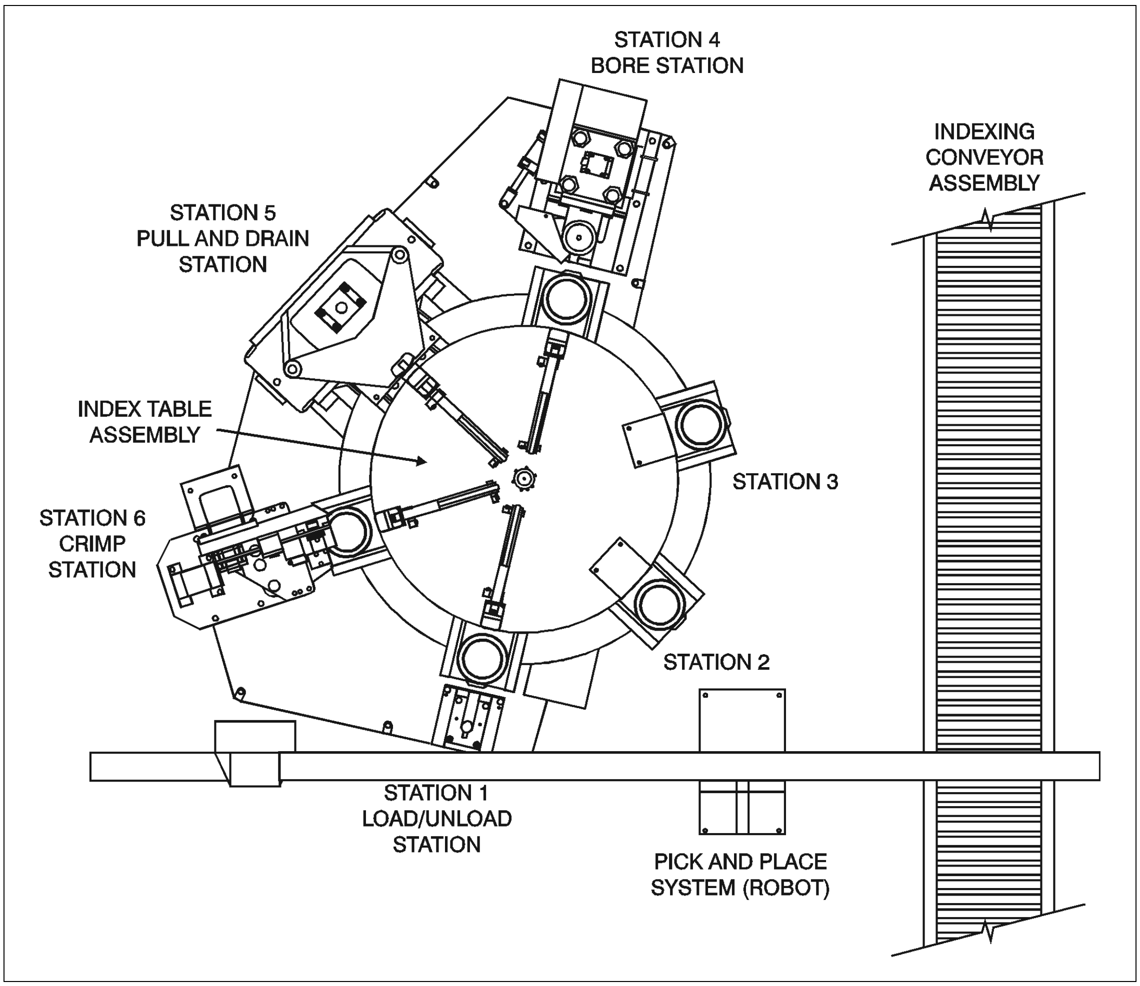

Figure 4-8: Multipurpose Demilitarization Machine

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

The MDM has four active workstations arranged on a six-position rotating table. These stations are as follows:

- Station 1: Load/Unload Station
- Station 4: Bore Station
- Station 5: Pull and Drain Station
- Station 6: Crimp Station

(Stations 2 and 3 are empty workstations)

Station 1: Load/Unload Station

The load/unload station receives munitions from the PKPL. After the munition has been processed, it is picked up by the PKPL and transferred back to the tray on the conveyor.

Station 4: Bore Station

The bore station is normally bypassed unless the projectile lot is determined to have burster wells that have been seal-welded to prevent vapor leakage around the press-fit area. This station bores out the welded portion of the burster well press-fit area, allowing the burster well to be pulled at the pull and drain station.

Station 5: Pull and Drain Station

At the pull and drain station, burster wells are extracted from munitions to expose the agent cavity allowing a drain tube to be inserted to remove the agent. After draining, the burster well is reinserted into the munition body prior to moving to the crimp station.

Agent Collection and Drain Verification System - The agent collection system for the MDM drains the projectile using a vacuum system. It has one pump that first evacuates the agent from the munition into the agent quantification system (AQS) verification tanks.

After the munition has been fully drained, the same pump then transfers the agent to the collection system tanks in the toxic cubicle. The drain verification system ensures that the munition has been fully drained (at least 95%).

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

Station 6: Burster Well Crimp Station

At the crimp station, the burster wells are again removed from the munition body. A portion of the burster well is deformed and the burster well is reinserted into the munition. The deformation consists of crimping the burster well using a set of jaws at the press fit area, which prevents the burster well from being reinserted completely back into the munition. This operation is required to provide an exit route between the burster well and the munition body for vapors generated by the agent residue during thermal processing in the metal parts furnace.

Once a tray of projectiles/mortars has completed the agent removal operation, the tray is transported to the lift car assembly. The lift car assembly transfers the tray from the munitions processing bay to the first floor buffer storage area. There the trays are stored until the metal parts furnace is available for operation.

3. PROJECTILE/MORTAR REJECT HANDLING

Projectiles and mortars can be rejected at three different locations in the projectile handling system:

- Projectile/Mortar Disassembly Machine
- Multiposition Loader
- Multipurpose Demilitarization Machine

Reject tables are provided to collect the rejected munitions from any of these locations.

REJECT HANDLING AT THE PMD

Projectiles and mortars can be rejected by the PMD when difficulties arise in removing the nose closure or the explosive components. A reject munition remains on the index table until it returns to the load station (Station 1).The infeed/transfer conveyor assembly and required conveyors run in reverse to remove the rejected munition from the PMD and transport it into the explosive containment vestibule where the reject system pushes the munition onto a reject table.

INFORMATION SHEET 4-2-1 (Continued)
PROJECTILE HANDLING SYSTEM

REJECT HANDLING AT THE MPL

Projectiles/mortars can be rejected if a burster is detected in the munition by a burster probe sensor located prior to the projectile tilting conveyor. If a burster is detected, the munition is flagged as a reject and is moved to a reject table by the MPL.

REJECT HANDLING AT THE MDM

Projectiles and mortars can also be rejected at the MDM if the munition is not properly processed at all the required stations. It is placed on the MDM reject table by the pick and place machine.

OUTLINE SHEET 4-3-1
MINE HANDLING SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 4-3-1 “Mine Handling System”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Mine Handling System.

   1.1 **IDENTIFY** the purpose of the Mine Handling System.

   1.2 **IDENTIFY** the function of the following major components of the Mine Handling System:

   - Mine Machine
   - Agent Quantification System

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Process Description/Major Components

   a. Unpack Area (UPA) Operations

   b. Mine Machine

      (1) Orientation Station

      (2) Punch and Drain Station

      (3) Trolley Pickup Assembly

      (4) Fuze Adapter Removal Station (FARS)

   d. Agent Quantification System

INFORMATION SHEET 4-3-1
MINE HANDLING SYSTEM

A. INTRODUCTION

This sheet provides information on the handling and processing of M23 Land Mines at a Chemical Agent Disposal Facility.

B. REFERENCES

1. TOCDF Functional Analysis Workbook

2. Programmatic Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The mine handling system (Figure 4-9) is used to safely receive and destroy M23 land mines. Land mines packed in drums containing three mines, fuzes, and activators. The drums are unpacked in the unpack area (UPA). The fuzes and activators are loaded into a cardboard container. Mines and cardboard containers are moved through the Explosive Containment Vestibule (ECV) into the ECR by an airlock and conveyor assembly. In the ECR, the land mines are punched and the drained agent is sent to the Toxic Cubicle (TOX) for storage until it is processed in the liquid incinerator. The empty mine casings and explosives are fed via a chute through two ECR blast gates to the deactivation furnace system. The contaminated mine drums are fed to the metal parts furnace.

INFORMATION SHEET 4-3-1 (Continued)
MINE HANDLING SYSTEM

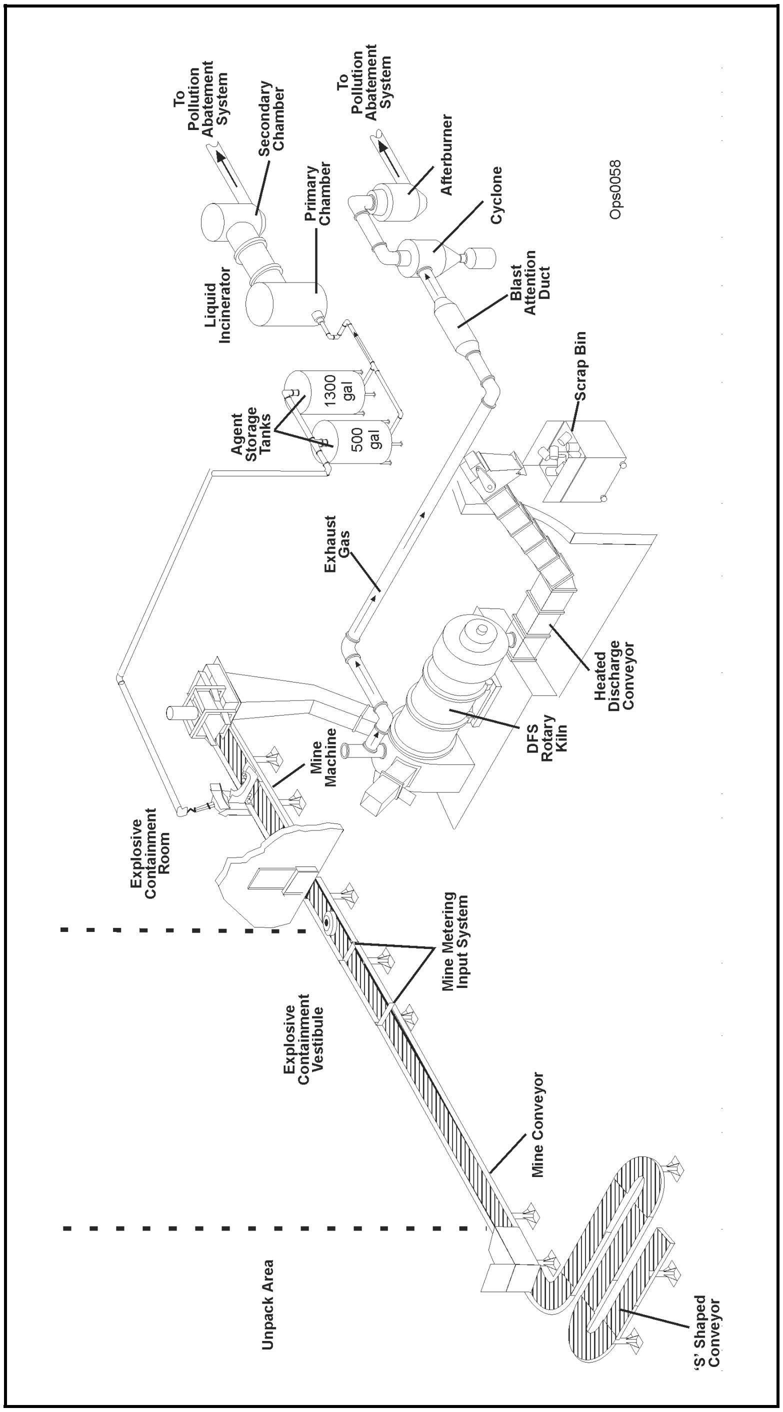

Figure 4-9: Mine Processing Overview

INFORMATION SHEET 4-3-1 (Continued)
MINE HANDLING SYSTEM

Mines, fuzes, and activators are packaged in drums. Each drum contains three fuzes, three activators, three mines, and packing material. Figure 4-10 shows a cutaway view of the packed mines as well as the components of the M23 mine.

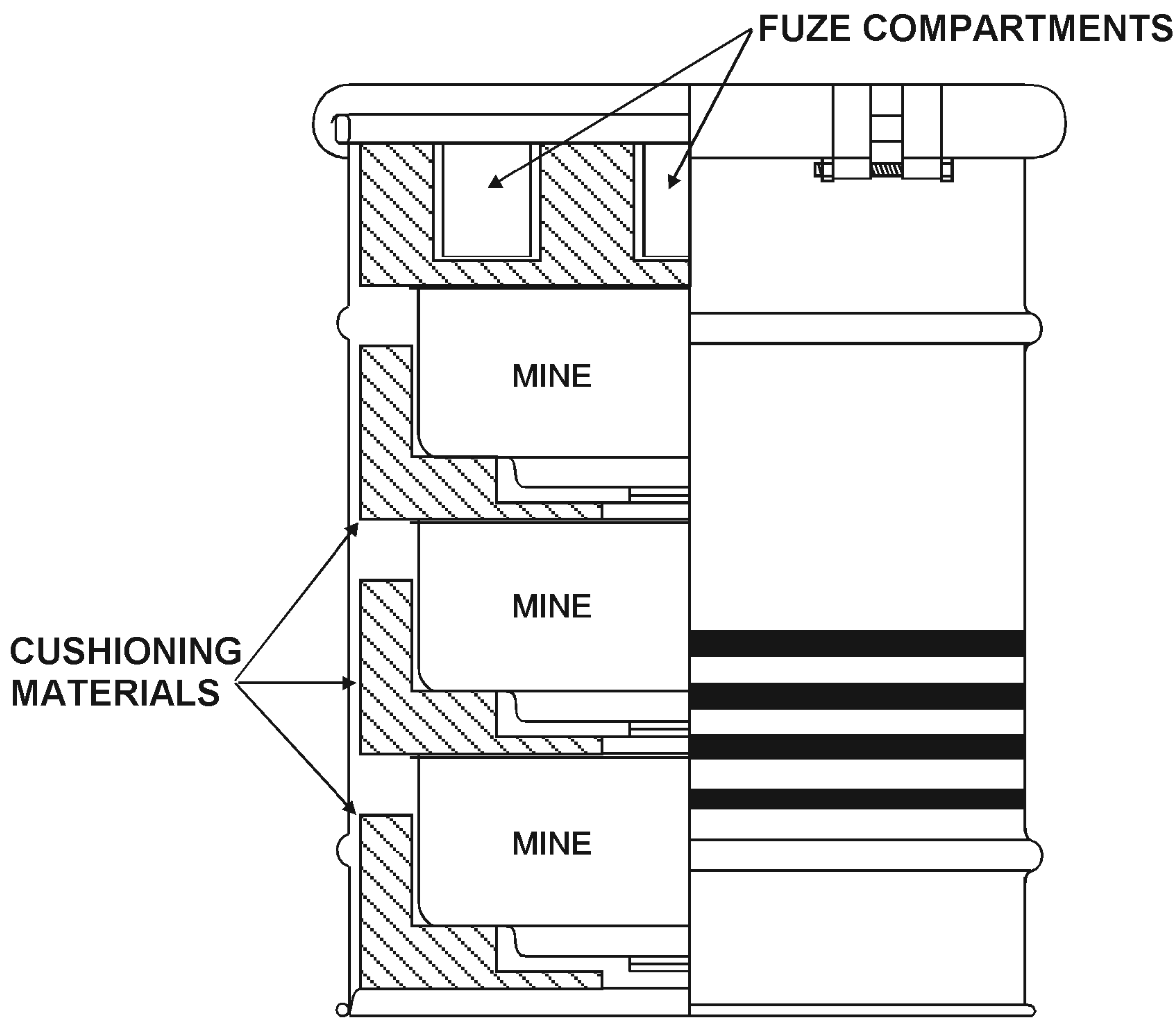

Figure 4-10: M23 Land Mine Storage Drum

INFORMATION SHEET 4-3-1 (Continued)
MINE HANDLING SYSTEM

2. PROCESS DESCRIPTION/MAJOR COMPONENTS

UNPACK AREA (UPA) OPERATIONS

The operators in the UPA will open and dismantle the pallet by snipping the banding wires and cutting them to a convenient size for handling. The locking ring bolt is also cut and the locking ring is lowered around the drum. The drum is sampled to verify no agent is present. All dunnage (banding, locking ring bolts, and pallet material) is placed in a dunnage basket for storage and disposal. Fuzes and adapters are loaded into a cardboard fuzebox and fed into the ECV by an airlock assembly. Mines are staged in the ECV by a metering assembly and fed into the ECR.

MINE MACHINE

The Mine Machine is designed to punch the M23 landmine and drain the agent from the mine. (Figure 4-11) The Mine Machine consists of the following stations:

- Mine Component Container Verification Station
- Orientation Station
- Punch and Drain Station
- Trolley Transfer Station
- Fuzewell Adapter Removal Station (FARS)

Mine Component Container Verification Station

The purpose of the Mine Component Container Verification Station is to differentiate between an M23 landmine and a Mine Component Container. The following is a list of the mine component container verification station components (Figure 4-12) and their purposes:

- **Index and Feed Stops** - Allows the feed of one mine at a time
- **Verification Probe** - Detects for a mine component container center hole
- **Metal Mine Sensor** - Provides a PLC feedback for a metal detection at the sensor

INFORMATION SHEET 4-3-1 (Continued)
MINE HANDLING SYSTEM

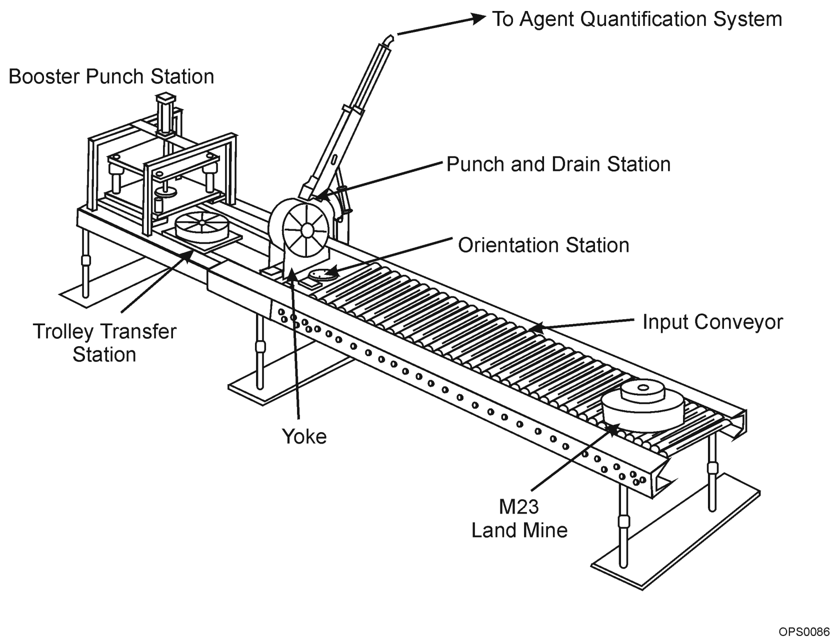

Figure 4-11, Mine Machine

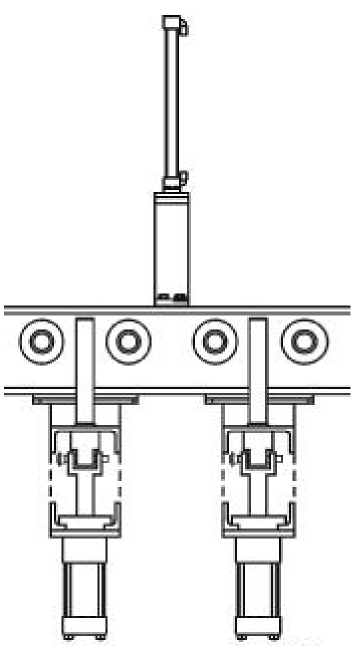

Figure 4-12,
Mine Component Container
Verification Station

INFORMATION SHEET 4-3-1 (Continued)
MINE HANDLING SYSTEM

Orientation Station

The M23 land mine arrives at the orientation station right side up. The orientation station rotates the mine and positions it in the yoke so that when the mine is punched, the punch does not strike the side burster well.

Punch and Drain Station

After the mine has been properly orientated, the mine is lifted from the horizontal to the vertical position. The Punch and Drain Station secures the mine while it is punched and drained of agent. The agent is pumped from the mine cavity and its volume verified to assure that all the agent has been removed.

Trolley Pickup Assembly

After the drain cycle is complete, the punch and drain station releases the mine. The mine is then lowered from the vertical position to the horizontal position (upside down) and placed on the trolley. The trolley assembly then moves the mine to the Fuze Adapter Removal Station.

Fuze Adapter Removal Station (FARS)

At the FARS, an assembly is extended and the base plate is unthreaded. The trolley retracts to mid position leaving the mine on the FARS table. The assembly is retracted and the trolley is driven forward again to push the mine off the table and into the mine hopper where it is directed to the DFS feed gate.

As fuze boxes enter the orientation station, the punch and drain station is bypassed and the fuzebox is rotated directly to the trolley. The fuzebox is then processed in the same manner as mines.

AGENT QUANTIFICATION SYSTEM

After the agent drain cycle is complete, a verification must be performed to ensure that at least 95% of the agent was drained. This is done in the agent quantification system (AQS) verification tank. Control room operators use the tank measurement to determine the exact percentage of agent drained from the munition.

OUTLINE SHEET 4-4-1
BULK CONTAINER HANDLING SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 4-4-1 "Bulk Container Handling System".

B. LESSON OBJECTIVES

1. **DESCRIBE** the Bulk Container Handling System.

   1.1 **IDENTIFY** the purpose of the Bulk Container Handling System.

   1.2 **IDENTIFY** the different types of Bulk Containers in the Chemical Stockpile Disposal Program.

   1.3 **IDENTIFY** the function of the following major components of the Bulk Container Handling System:

   - Bulk Drain Station Indexing Hydraulic Conveyor
   - Bulk Drain Station

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Process Description/Major Components

   a. Bulk Drain Station Indexing Hydraulic Conveyor

   b. Bulk Drain Station

      (1) Punch Station

      (2) Drain Station

INFORMATION SHEET 4-4-1
BULK CONTAINER HANDLING SYSTEM

A. INTRODUCTION

This sheet provides information on the handling and processing of the various bulk containers at a Chemical Agent Disposal Facility.

B. REFERENCES

1. TOCDF Functional Analysis Workbook
2. Programmatic Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The Bulk Container Handling System (Figure 4-13) is designed to safely remove agent from bulk container items. Bulk containers consist of ton containers, bombs, and spray tanks.

The bulk item demilitarization process begins in the unpack area. Operators take bulk munitions out of pallets or shipping containers and place them in steel cradles. The cradles are loaded into trays on a conveyor and are transported to the bulk drain station. At the bulk drain station, the item is punched and the agent is drained and sent to the toxic cubicle before being destroyed in the Liquid Incinerator. The drained container is then conveyed to the Metal Parts Furnace (MPF) for thermal processing.

INFORMATION SHEET 4-4-1 (Continued)
BULK CONTAINER HANDLING SYSTEM

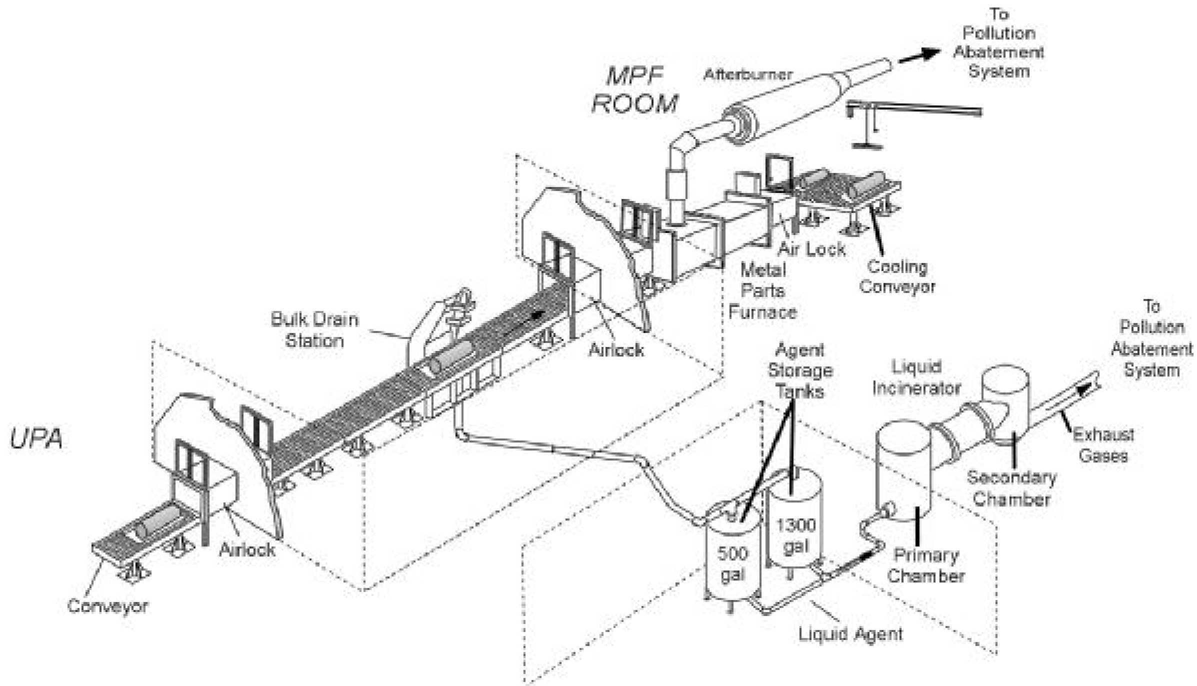

Figure 4-13: Bulk Container Handling System

INFORMATION SHEET 4-4-1 (Continued)
BULK CONTAINER HANDLING SYSTEM

2. PROCESS DESCRIPTION/MAJOR COMPONENTS

BULK DRAIN STATION INDEXING HYDRAULIC CONVEYOR

The function of the BDS Indexing Hydraulic Conveyor is to slowly advance the tray containing the bulk item(s) through the punch and drain sequence of the bulk drain station and to stop the tray at the correct position for each step. The conveyor is mounted on a hydraulically actuated lift table, which raises and lowers the entire conveyor holding the tray. When the lift is raised, the conveyor rollers support the tray and the tray can be moved. When the lift is lowered, the conveyor rollers drop below the level of an internal steel frame. The frame is designed to hold and support the tray during the punching operation (the lift table is not lowered when processing spray tanks).

Built into the conveyor supports are four load cells, which constantly sense the weight supported by the conveyor when the conveyor is raised. These cells are used with the conveyor in the raised position to measure the weight of the bulk items before and after they are drained to determine beginning and ending weights. These weights are used for verification of the drain cycle.

BULK DRAIN STATION

The Bulk Drain Station (BDS) (Figure 4-14) is a hydraulically-powered machine used to access and remove chemical agent from bulk containers. The BDS is positioned adjacent to the BDS indexing hydraulic conveyor. It consists of a punch station and a drain station.

Punch Station

The punch station consists of a hydraulic cylinder equipped with a punch and a hold-down clamp. the hydraulic cylinder is mounted vertically on the upper front of the BDS column assembly which stands next to the BDS indexing conveyor. When the cylinder is extended, the cylinder punches a hole through the top of the bulk item.

The hold-down clamp is mounted on the punch itself and is used to hold the bulk item in the cradle when the punch is retracted. This is to prevent the punch catching on the bulk item and lifting it off the conveyor.

INFORMATION SHEET 4-4-1 (Continued)
BULK CONTAINER HANDLING SYSTEM

Drain Station

The drain station consists of an agent drain probe that is lowered into the bulk item through the hole made by the punch. The agent drain probe is a stainless steel tube connected by flexible tubing to the agent transfer pump. The agent transfer pump is used to transfer agent from bulk drain station to the toxic cubicle. These pumps are air operated diaphragm pumps.

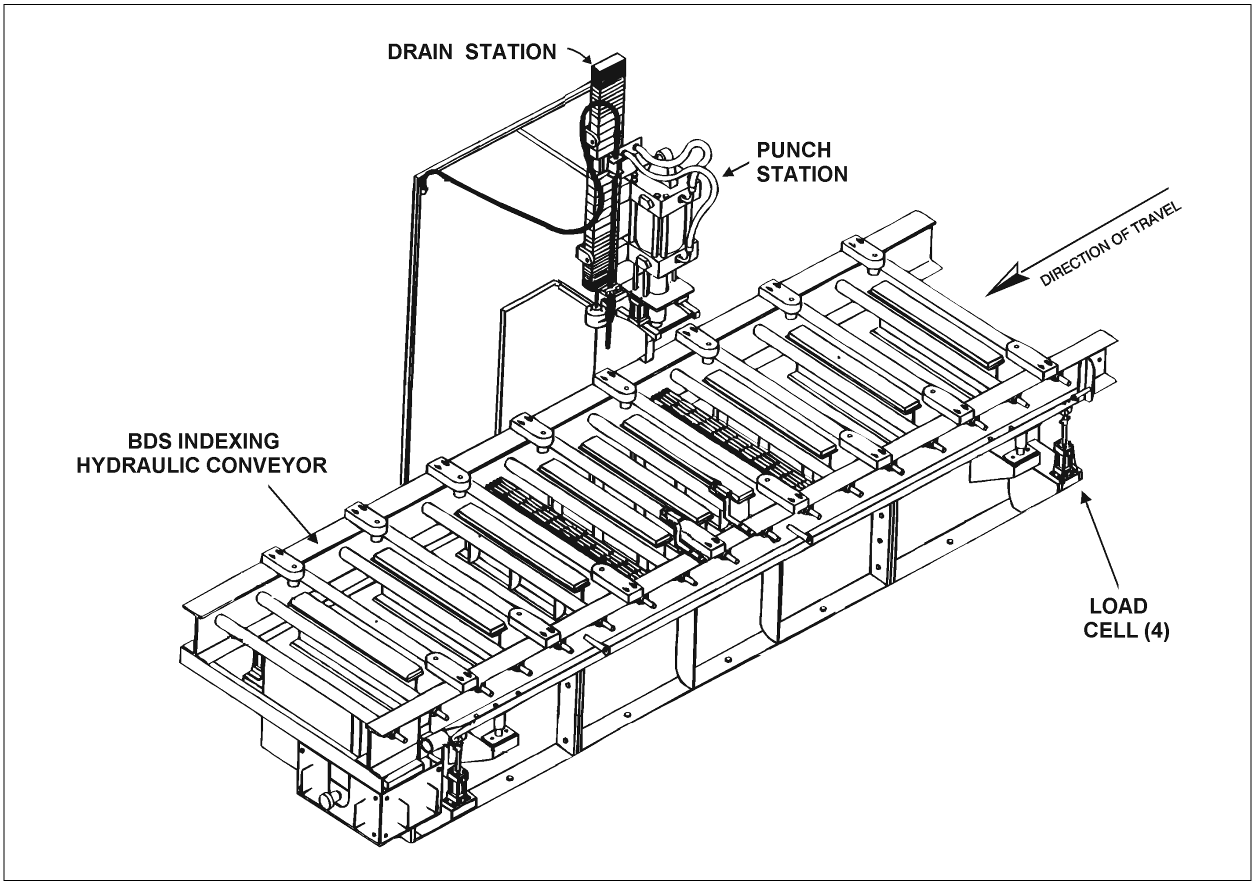

Figure 4-14: Bulk Drain Station

UNIT 5: INCINERATION PROCESSES

OUTLINE SHEET 5-1-1
FUEL GAS SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 5-1-1 “Fuel Gas System”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Fuel Gas System.

   1.1 **IDENTIFY** the purpose of the Fuel Gas System.

   1.2 **IDENTIFY** the two independent systems of the Fuel Gas System.

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Process Descriptions

   a. Natural Gas Supply

   b. Liquefied Petroleum Gas Supply

      (1) LPG Unloading Station

      (2) LPG Storage Tank

      (3) LPG Transfer Pump

      (4) LPG Vaporizer

      (5) LPG Dilution Air Compressor and Dryer

      (6) LPG/Air Blender

      (7) LPG Distribution

INFORMATION SHEET 5-1-1
FUEL GAS SYSTEM

A. INTRODUCTION

This sheet provides information on fuel gas supply system for the demilitarization sites.

B. REFERENCES

1. ANCDF Functional Analysis Workbook

2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The purpose of the Fuel Gas System is to supply a continuous source of regulated gas to site loads. The primary users of fuel gas are the incinerator systems. Other users include the brine reduction area pollution abatement systems, steam generation system boilers, and hot water boilers.

Fuel gas is supplied to the site through the following two independent systems (see Figure 5-1):

- Natural Gas System
- Liquefied Petroleum Gas System

2. PROCESS DESCRIPTIONS

NATURAL GAS SUPPLY

Natural gas is piped directly from the utility company pipeline into the Demilitarization Facility fuel gas supply. Fuel gas pressure is reduced to less than 35 psig before the gas is distributed via the supply header inside the facility, where the pressure is further reduced before use in individual loads. The flow rate is metered and the pressure is monitored.

INFORMATION SHEET 5-1-1 (Continued)
FUEL GAS SYSTEM

LIQUEFIED PETROLEUM GAS SUPPLY

The Liquefied Petroleum Gas (LPG) system is capable of storing and supplying an alternate source of fuel gas for site loads. LPG is blended with air to form an LPG to air mixture equivalent to that of natural gas.

LPG Unloading Station

The unloading station is used to unload LPG shipments from a tanker truck to the LPG Storage Tank. A pressure equalization line from the LPG Storage Tank to the tanker truck allows the pressure between the two tanks to be equalized to permit transfer operations.

LPG Storage Tank

LPG Storage Tank is located adjacent to the Process and Utility Building. LPG is stored in the storage tank until required to serve as the plant fuel source. Dual-purpose, fire-safety valves are located at the LPG storage tank inlet, outlet, and return lines and are closed automatically by thermal switches. The fire-safety valves are also controlled from the local panel for the inlet and pressure equalization lines or from the control room for the outlet and bypass lines. The control room hand switches are always in manual. The thermal switches are set to override any other control when active and to close the valves at 250 °F. The storage tank is protected from overpressure by a safety relief valve.

LPG Transfer Pump

LPG from the LPG Storage Tank is transferred to the vaporizer by the LPG Transfer Pump. A recirculation line regulates the return of LPG to the storage tank as the system demand changes.

LPG Vaporizer

The LPG Vaporizer converts the liquid petroleum gas into a vapor. The vaporizer contains a burner which heats a glycol/water mixture. The glycol/water mixture is recirculated through a heat exchanger by a glycol/water circulation pump. As the liquid petroleum gas is passed through the heat exchanger, it changes to a vapor state. The vaporizer and all associated components are located adjacent to the LPG Storage Tank.

INFORMATION SHEET 5-1-1 (Continued)
FUEL GAS SYSTEM

LPG Dilution Air Compressor and Dryer

Compressed air is supplied to the LPG/Air Blender normally from the LPG Dilution Air Compressor. Compressed air from the LPG Dilution Air Compressor is dried using the LPG Dilution Air Dryer. This is a refrigerated type air dryer, which removes moisture by cooling the compressed air to condense the water vapor. Plant air can be used as the alternate source of air to the blender, but it is piped in downstream of the Dilution Air Dryer since it has already been dried.

LPG/Air Blender

LPG vapor has a higher BTU value per standard cubic foot than natural gas. The LPG/Air Blender is used to mix air into the LPG vapor giving the LPG vapor the same BTU value per standard cubic foot as natural gas. This allows either the LPG supply or the natural gas supply to be used without changing the furnace burner configuration.

LPG Distribution

Gas from the LPG/Air Blender is distributed to process plant loads using the same common fuel gas header as used by natural gas. Since the Natural Gas System and the LPG System supply share a common distribution header, the loads supplied by each of the systems are the same. The two systems are not operated in parallel.

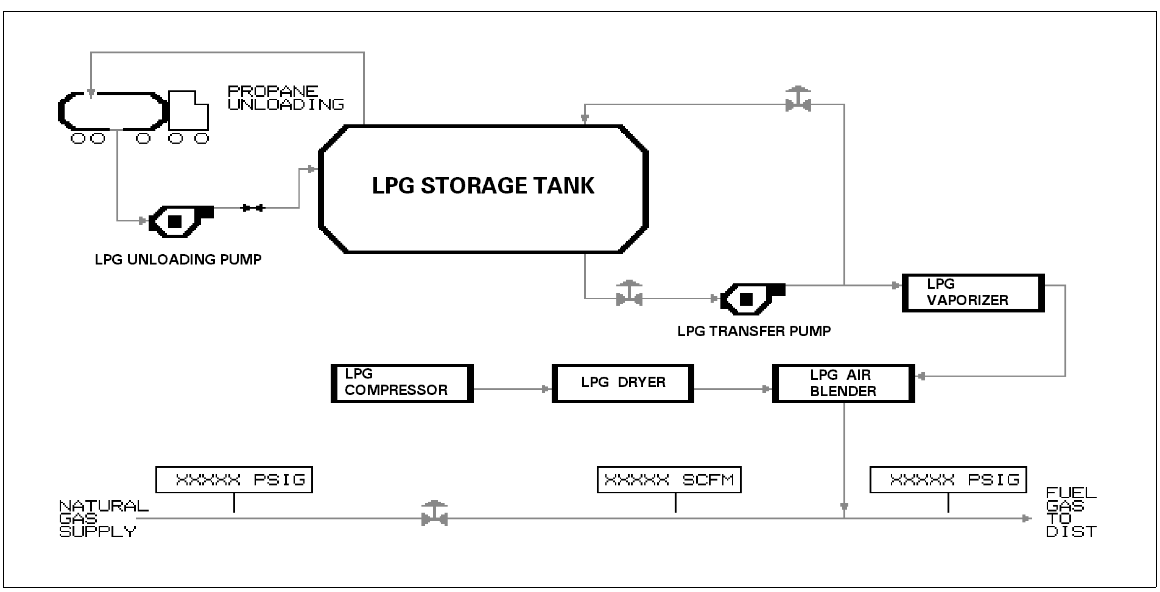

Figure 5-1: Fuel Gas Supply Systems

OUTLINE SHEET 5-2-1
TOXIC STORAGE AND HANDLING SYSTEMS

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 5-2-1 "Toxic Storage and Handling Systems".

B. LESSON OBJECTIVES

1. **DESCRIBE** the Agent Collection System.

    1.1 **IDENTIFY** the purpose of the Agent Collection System.

    1.2 **IDENTIFY** the function of the following major components of the Agent Collection System:

    - Agent Holding Tank
    - Agent Surge Tank
    - Agent Feed Pumps

2. **DESCRIBE** the Spent Decon System.

    2.1 **IDENTIFY** the purpose of the Spent Decon System.

    2.2 **IDENTIFY** the two subsystems that make up the Spent Decon System.

    2.3 **IDENTIFY** the function of the following major components of the Spent Decon System:

    - Sumps
    - Sump Pumps
    - Spent Decon Holding Tanks
    - Spent Decon Feed Pumps
    - Agent Spill Transfer Pump

OUTLINE SHEET 5-2-1 (Continued)
TOXIC STORAGE AND HANDLING SYSTEMS

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Agent Collection System

   a. Process Description/Major Components

      (1) Agent Holding Tank

      (2) Agent Surge Tank

      (3) Agent Feed Pumps

3. Spent Decon System

   a. Spent Decon Collection System

      (1) Sumps

      (2) Sump Pumps

   b. Spent Decon Storage and Feed System

      (1) Spent Decon Holding Tanks

      (2) Spent Decon Feed Pumps

      (3) Agent Spill Transfer Pump

INFORMATION SHEET 5-2-1
TOXIC STORAGE AND HANDLING SYSTEMS

A. INTRODUCTION

This sheet provides information on the systems that make up the toxic storage and handling system.

B. REFERENCES

1. ANCDF Functional Analysis Workbook

2. TOCDF Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The toxic storage and handling system provides collection, storage, and transfer of hazardous liquids (agent or any contaminated liquid) for decontamination or destruction through incineration. After the quantitative and/or qualitative verification process, both agent and spent decon are pumped to the liquid incinerator (LIC) for destruction or decontamination by incineration. The toxic storage and handling system consists of two functional areas:

- Agent Collection System
- Spent Decon System

2. AGENT COLLECTION SYSTEM

The agent collection system (Figure 5-2) is designed to receive, store, and transfer agent drained from munitions and bulk items. Agent received from the drain stations is transferred through the agent quantification system to the agent holding tank until it can be pumped to the liquid incinerator (LIC) primary chamber for incineration. The equipment for the agent collection system is primarily located in the toxic cubicle and consists of the following:

- Agent Holding Tank
- Agent Surge Tank
- Agent Feed Pumps

INFORMATION SHEET 5-2-1 (Continued)
TOXIC STORAGE AND HANDLING SYSTEMS

PROCESS DESCRIPTION/MAJOR COMPONENTS

Agent Holding Tank

The agent holding tank receives agent from the munitions drain systems after quantity verification. The agent holding tank is located in the toxic cubicle. It is designed to store the minimum amount of agent required to supply the LIC furnace under normal conditions.

Agent Surge Tank

The agent surge tank serves as a backup in case the agent holding tank reaches its high-high level or in the case of an agent spill in the toxic cubicle. The agent surge tank also receives liquid from the agent spill transfer pump. The tank is located in the toxic cubicle.

Agent Feed Pumps

The agent feed pumps are used to feed agent from the Agent Holding Tank or Agent Surge Tank to the Liquid Incinerators.

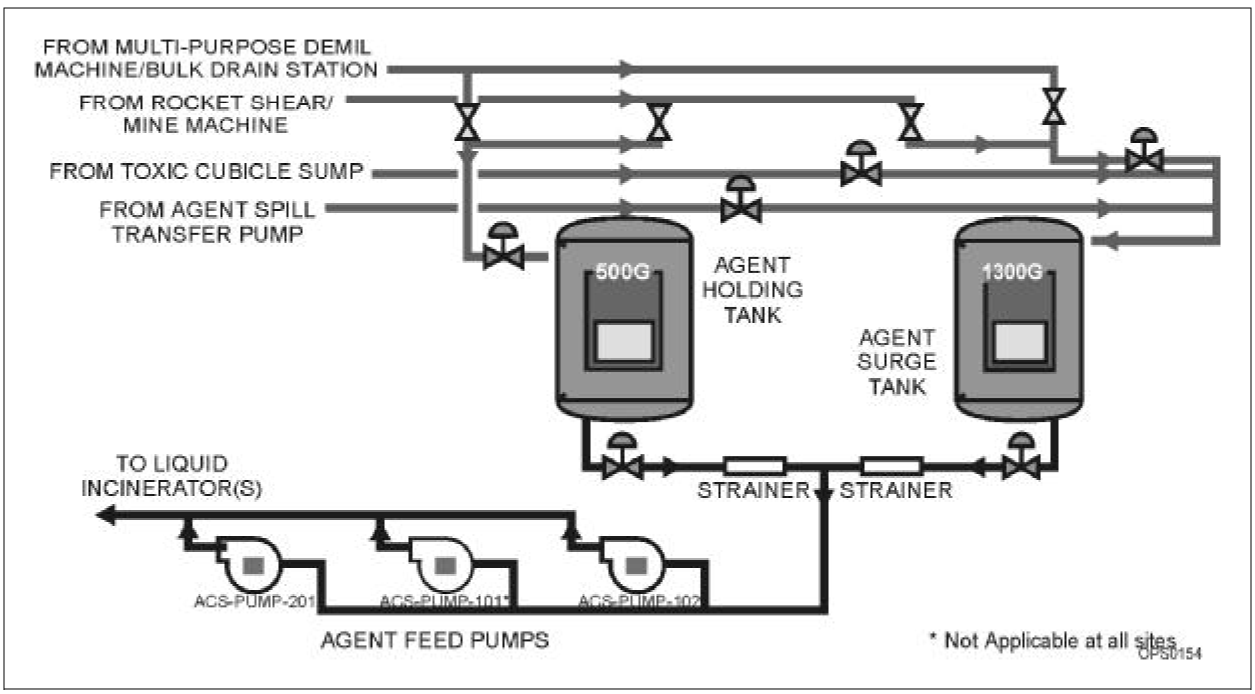

Figure 5-2: Agent Collection System

INFORMATION SHEET 5-2-1 (Continued)
TOXIC STORAGE AND HANDLING SYSTEMS

3. SPENT DECON SYSTEM

The spent decon system is designed to collect and store the spent decon that results from the decontamination and washdown of agent-contaminated equipment or personnel. The spent decon system consists of two subsystems:

- Spent Decon Collection System
- Spent Decon Storage and Feed System

SPENT DECON COLLECTION SYSTEM

The spent decon collection system (Figure 5-3) is used to collect spent decon and liquid waste from the various areas of the plant through the use of area sumps. The sumps are intended to collect process water, spent decon, and agent from spills.

Sumps

The system consists of sumps which are located throughout the Munitions Demilitarization Building (MDB). The sump provides a means to collect spent decon or spills by creating a low point drain area. The spent decon is collected from three categories of agent contamination:

- Category A: areas of high probability of liquid or vapor agent contamination
- Category B: areas of high probability of agent vapor contamination
- Category C: areas of low probability of agent vapor contamination

Sump Pumps

Each sump contains a sump pump used to transfer collected liquid waste from the sumps to the spent decon holding tanks. Each sump pump is air operated with a suction strainer to prevent pump damage from foreign objects which could collect in the sump.

INFORMATION SHEET 5-2-1 (Continued)
TOXIC STORAGE AND HANDLING SYSTEMS

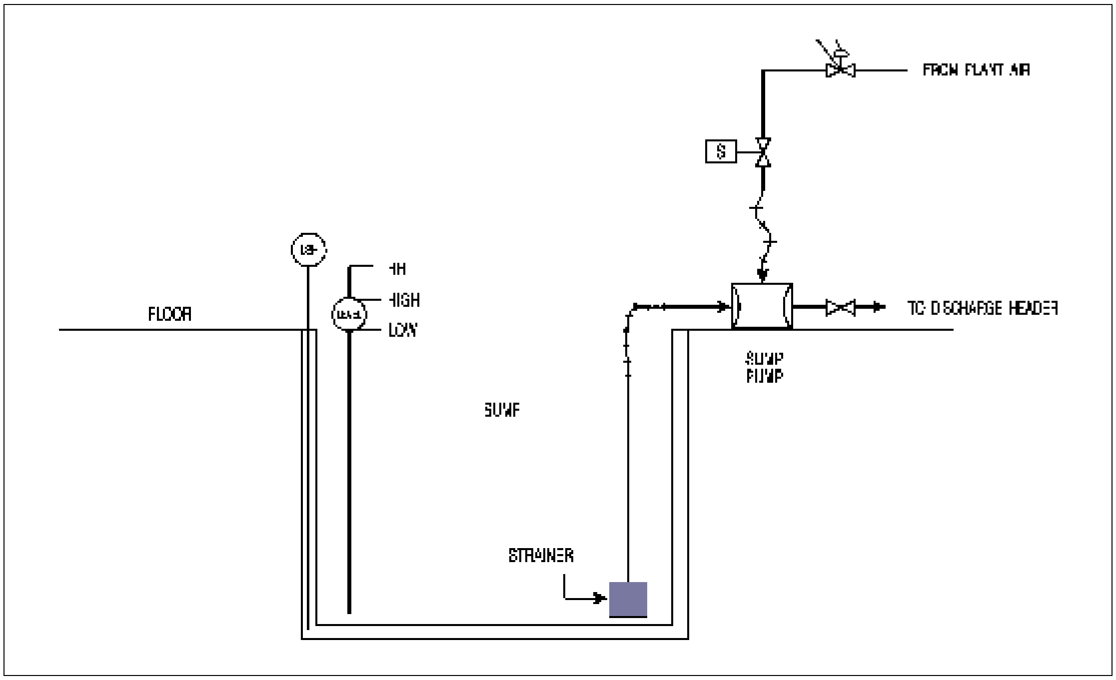

Figure 5-3: Spent Decon Collection Sump

INFORMATION SHEET 5-2-1 (Continued)
TOXIC STORAGE AND HANDLING SYSTEMS

SPENT DECON STORAGE AND FEED SYSTEM

The spent decon storage and feed system (Figure 5-4) provides a means of storing spent decon and liquid waste collected from the plant processing areas. The system is also used to feed the collected waste to the Liquid Incinerator secondary chamber.

Spent Decon Holding Tanks

Spent decon (used decontamination liquids) and liquid wastes collected from the plant are stored in Spent Decon Holding Tanks. There are three holding tanks.

Two tanks are configured to receive spent decon, and one tank is configured to receive agent from a major spill. The two tanks selected for spent decon are classified as primary fill tank and secondary fill tank. A discharge header from each sump category is piped to each of the three holding tanks. This allows any sump category to be aligned to any of the three tanks.

Eighteen percent Sodium Hydroxide (18% NaOH) and five and one-half percent Sodium Hypochlorite (5.50% NaOCl) can be supplied to each tank. Sodium Hydroxide or Sodium Hypochlorite is used to neutralize agent prior to feeding to the liquid incinerator secondary chamber.

Spent Decon Feed Pumps

Spent decon from the holding tanks is transferred to Liquid Incinerator (LIC) secondary chamber for thermal decontamination and disposal by the spent decon feed pumps.

Agent Spill Transfer Pump

In the event that gross amounts of agent is ever detected in the spent decon collection sumps or a large agent spill is suspected, it is pumped directly to the spent decon holding tank selected as the major agent spill tank. Gross amounts of agent received in the major agent spill tank is transferred directly to the agent surge tank in the Toxic Cubicle by the air operated Agent Spill Transfer Pump. The agent may also be neutralized and fed to the liquid incinerator secondary chamber.

INFORMATION SHEET 5-2-1 (Continued)
TOXIC STORAGE AND HANDLING SYSTEMS

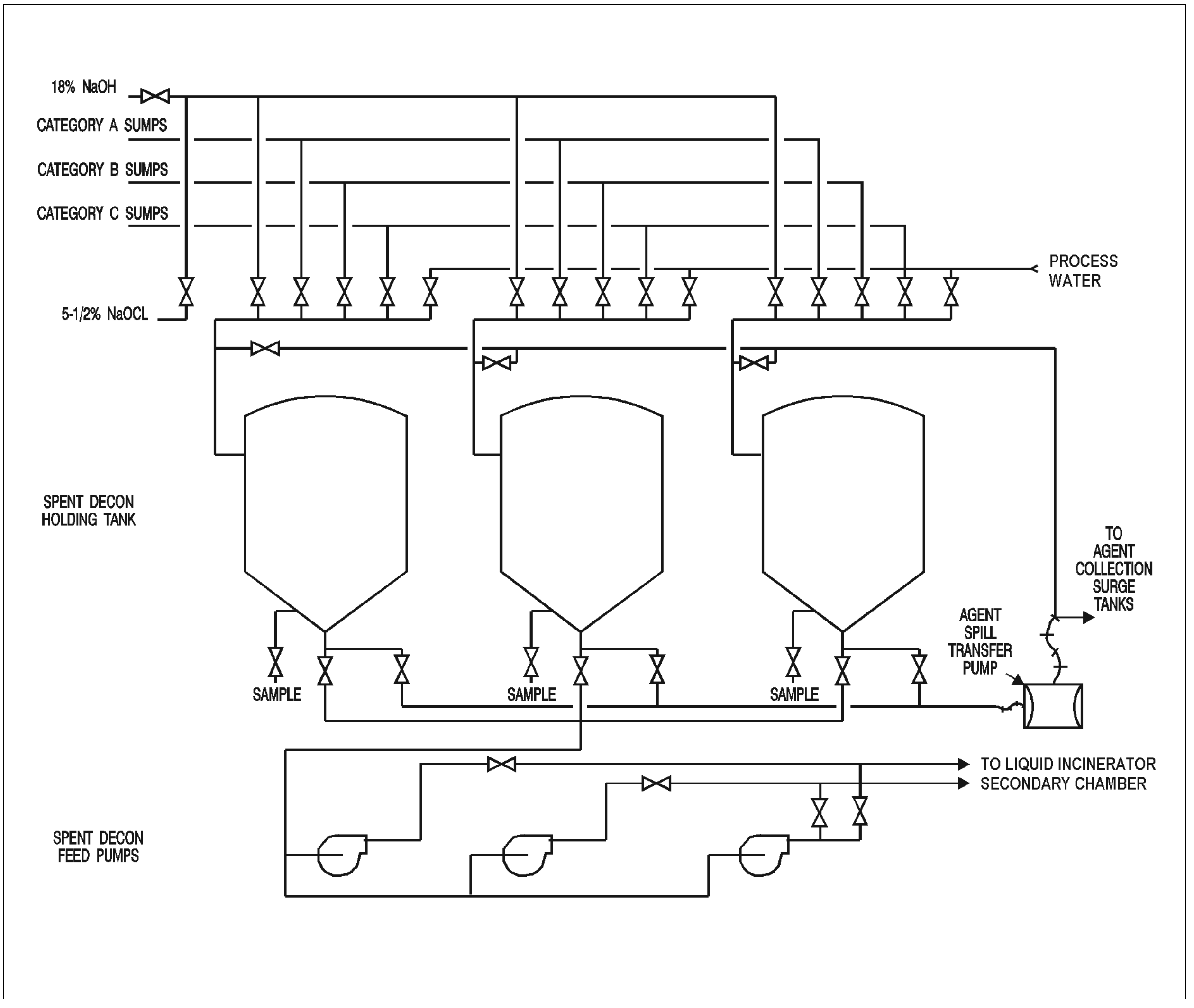

Figure 5-4: Spent Decon Storage & Feed System

OUTLINE SHEET 5-3-1
LIQUID INCINERATOR

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 5-3-1 “Liquid Incinerator”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Liquid Incinerator System.

   1.1 **IDENTIFY** the purpose of the Liquid Incinerator System.

   1.2 **IDENTIFY** the operating temperatures for the primary and secondary chamber.

   1.3 **IDENTIFY** the function of the following major components of the Liquid Incinerator System:

   - Primary Chamber
   - Secondary Chamber
   - Combustion Blowers

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Process Description/Major Components

   a. Primary Chamber

      (1) Agent Incineration Flow

      (2) Fuel Oil Purge Flow

   b. Secondary Chamber

      (1) LIC Slag Removal

   c. LIC Primary/Secondary Combustion Air Blowers

INFORMATION SHEET 5-3-1
LIQUID INCINERATOR

A. INTRODUCTION

This sheet provides information on the incineration process for the liquid agent and spent decontamination solutions.

B. REFERENCES

1. Programmatic Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The Liquid Incinerator (LIC) system (see Figure 5-5) is used to dispose of agent and spent decontamination solution through high-temperature incineration. Agent collected through the demilitarization processes is collected and stored until conditions are established for incineration in the LIC.

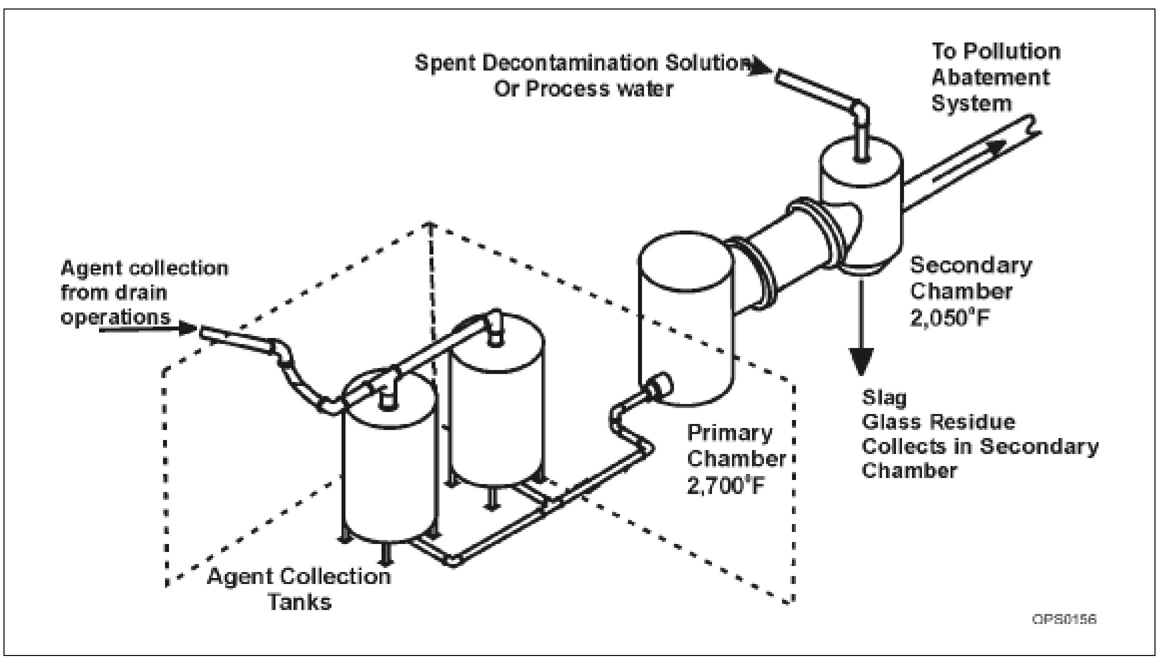

Figure 5-5: Overview of Liquid Incinerator Process

INFORMATION SHEET 5-3-1 (Continued)
LIQUID INCINERATOR

2. PROCESS DESCRIPTION/MAJOR COMPONENTS

PRIMARY CHAMBER

The LIC primary chamber is a refractory-lined steel cylinder set on one end with a flattened dome top. A low-velocity burner mounted in the lower wall of the chamber introduces the following into the chamber:

- Liquid Agent
- Combustion Air
- Fuel Gas
- Atomizing Air
- Purge Air
- Fuel Oil Purge Flow

Agent Incineration Flow

Liquid agent is pumped by an agent feed pump from the agent holding tank in the toxic cubicle (TOX) to the LIC primary chamber. Agent is pumped at a uniform, continuous rate to the primary chamber where the agent is dispersed into the burner with air-atomizing nozzles and mixed with combustion air. Fuel gas is used to ensure a stable flame pattern within the primary burner and to control chamber temperature. Combustion is controlled at about 2,700° F.

Furnace draft is supplied by the LIC induced draft fan, which is part of the LIC pollution abatement system. Flue gases from the LIC primary chamber are pulled by the induced draft fan through a refractory-lined crossover duct to the LIC secondary chamber, which serves as an afterburner to the primary chamber.

Fuel Oil Purge Flow

The agent feed line to the primary chamber is flushed out with compressed air and fuel oil to reduce the amount of residual agent in the system at the end of an agent-burning operation and prior to a controlled shutdown. The flush is performed while the primary chamber is still at operating temperature to ensure that purged residual agent is burned in the primary chamber.

INFORMATION SHEET 5-3-1 (Continued)
LIQUID INCINERATOR

SECONDARY CHAMBER

The LIC secondary chamber is cylindrical, refractory-lined, with a high-velocity burner mounted near the top of the chamber wall. The burner introduces combustion air and fuel gas into the chamber. A liquid spray nozzle is also mounted on the chamber roof, which feeds spent decon or process water and atomizing air into the chamber.

The LIC secondary chamber is maintained at a minimum operating temperature of 2050° F by a natural-gas fired burner. Spent decon is sprayed through an atomizing nozzle into the top of the secondary chamber where the atomized fluid stream mixes with flue gases from the primary chamber. The water in the spent decon feed is evaporated and any organic residue is combusted. If spent decon feed is not available, water is sprayed into the secondary chamber to control the secondary chamber temperature.

LIC Slag Removal

Salts in the spent decon solution collect on the walls of the secondary chamber, melt and flow to the bottom of the chamber as slag. Slag is periodically removed through an opening in the bottom of the secondary chamber where it is collected by the LIC slag removal system.

LIC PRIMARY/SECONDARY COMBUSTION AIR BLOWERS

The LIC primary and secondary combustion air blowers provide excess air in the chambers to ensure complete combustion of the fuel gas and complete destruction of the agent. The blowers supply room air through a vertical blower inlet duct to their respective burners. An annubar in the combustion air duct measures the mass of air flowing to the chambers. Flow is maintained by modulating a damper in the duct. Figure 5-6 shows a line diagram of the Liquid Incinerator System.

INFORMATION SHEET 5-3-1 (Continued)
LIQUID INCINERATOR

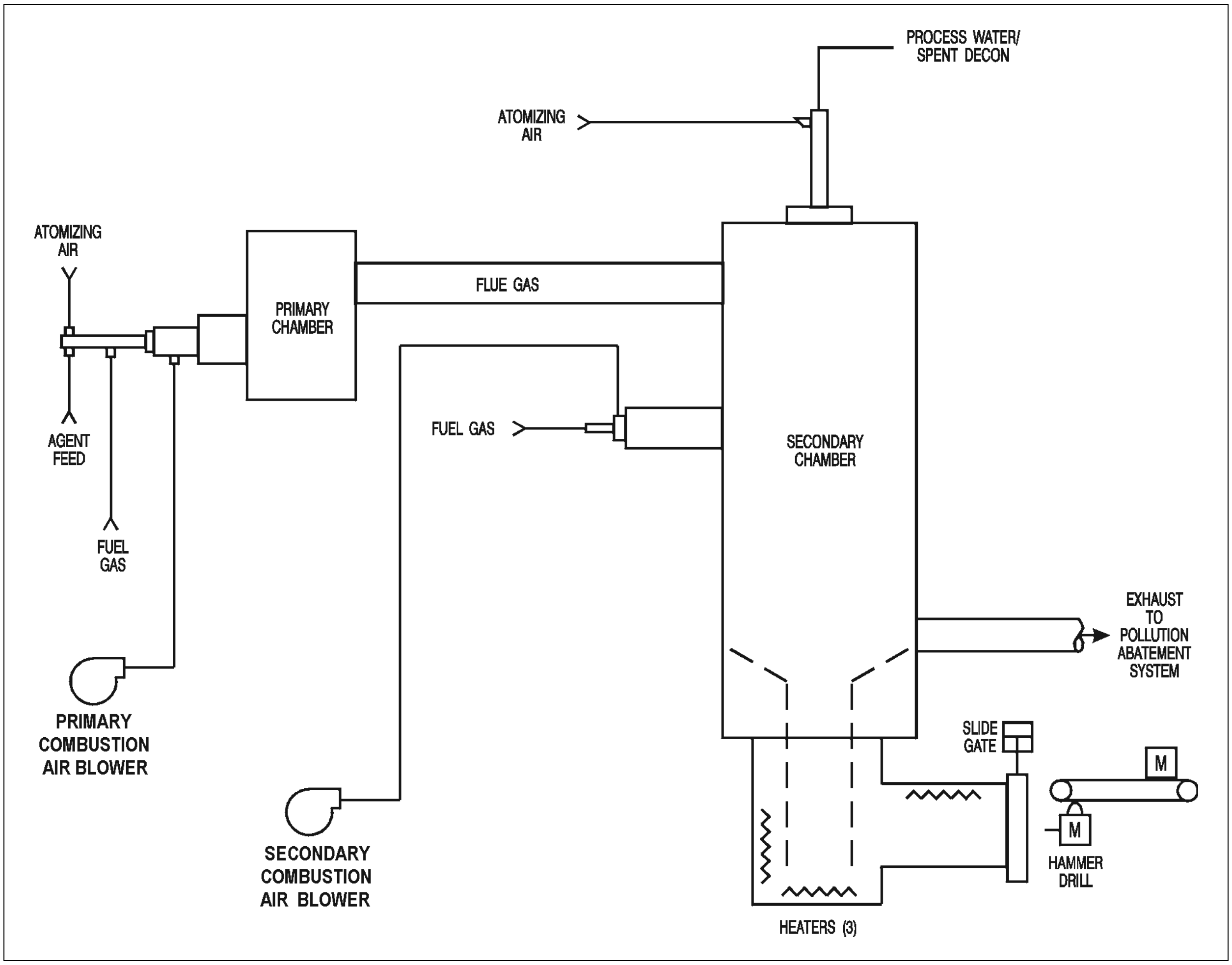

Figure 5-6: Liquid Incinerator

OUTLINE SHEET 5-4-1
DEACTIVATION FURNACE SYSTEM

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 5-4-1 “Deactivation Furnace System”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Deactivation Furnace System.

   1.1 **IDENTIFY** the purpose of the Deactivation Furnace System.

   1.2 **IDENTIFY** the function of the following major components of the Deactivation Furnace System:

   - Rotary Kiln
   - Kiln Combustion Blower
   - Heated Discharge Conveyor
   - Blast Load Attenuation Duct
   - Cyclone
   - DFS Afterburner

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Process Description/Major Components

   a. Rotary Kiln

      (1) Kiln Combustion Blower

   b. Heated Discharge Conveyor

   c. Blast Load Attenuation Duct

   d. Cyclone

   e. DFS Afterburner

INFORMATION SHEET 5-4-1
DEACTIVATION FURNACE SYSTEM

A. INTRODUCTION

This sheet provides information on the incineration process for residual liquid agent and energetic material that occurs in the Deactivation Furnace System.

B. REFERENCES

1. Programmatic Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The Deactivation Furnace System (DFS) is used to incinerate residual chemical agent and deactivate energetics from demilitarized munitions (see Figure 5-7). Components processed by the DFS include:

- Sheared Rockets
- Land Mines
- Energetics Removed from Projectiles

The furnace feedstock also includes fiberglass and fiberglass resin from processed rockets that were packed in fiberglass tubes with aluminum end caps.

The DFS has a rotary kiln design that is fed munition pieces from two chutes that exit the explosive containment rooms (ECRs). The kiln has an internal spiral baffle which keeps the munition pieces separated and moves them down the kiln. During this process, the burster and propellant are destroyed as is any residual agent. The solids discharged from the kiln are fed onto a heated discharge conveyor where 5X decontamination is completed. Decontaminated scrap then drops into a discharge bin outside the building.

The exhaust from the main furnace is processed through a cyclone separator to remove entrained fiberglass (from rocket shipping tubes) from the exhaust stream, and then through an after burner to incinerate any unburned combustion products. The furnace exhaust then flows through the DFS pollution abatement system.

INFORMATION SHEET 5-4-1 (Continued)
DEACTIVATION FURNACE SYSTEM

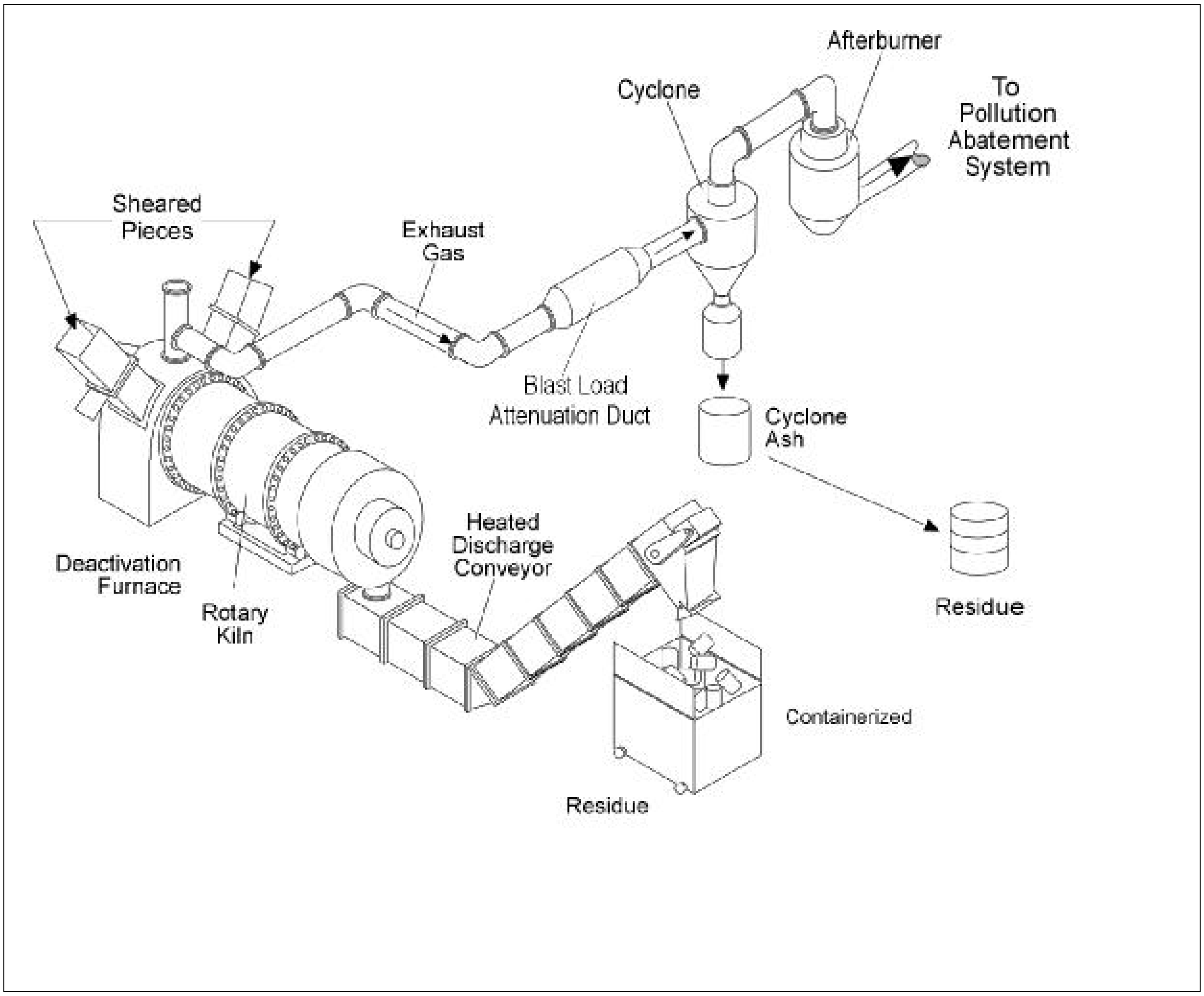

Figure 5-7: Process Overview of the Deactivation Furnace System

INFORMATION SHEET 5-4-1 (Continued)
DEACTIVATION FURNACE SYSTEM

2. PROCESS DESCRIPTION/MAJOR COMPONENTS

ROTARY KILN

The rotary kiln thermally deactivates and incinerates energetics and destroys residual organic chemicals. The kiln is a countercurrent furnace in which the munitions travel in the opposite direction of the exhaust gas stream.

The DFS rotary kiln is a steel alloy cylinder 32 ft 10 ½ in. long by 5 ft 1 in. outside shell diameter comprised of five sections bolted together. The kiln rotates on and is supported by trunnion rollers. As the kiln rotates, an internal spiral baffle (known as flights) conveys the material through the length of the rotary kiln. At each end of the rotating kiln is a stationary subassembly, one for charging the kiln and one for discharging.

The temperature inside the kiln is controlled by burning natural gas, in addition to the energetics, fiberglass resin, and residual agent. The gas/air mixture is fired through a conventional natural gas burner located in the discharge-end subassembly of the rotary kiln. The temperature is controlled by modulating the burner firing rate based on either the burner end temperature controller or the kiln exhaust temperature controller, whichever requires the greater fuel demand. The kiln burner end has a setpoint of 1100° F for rockets and 1050° F for all other munitions.

Kiln Combustion Blower

Combustion air is supplied to the primary burner by the kiln combustion air blower. Air is drawn from the DFS room through a vertical blower inlet duct and provides combustion air to the burner as well as cooling air for the flame scanner.

HEATED DISCHARGE CONVEYOR

The heated discharge conveyor is a 60 ft long bucket conveyor inside an insulated steel housing. The feed-end of the conveyor is connected to the kiln discharge assembly. Waste products (metal and fiberglass scraps) that have traveled through the kiln fall directly onto the bucket conveyor. The material is carried to the discharge-end of the conveyor located in a blast enclosure outside the DFS room wall.

INFORMATION SHEET 5-4-1 (Continued)
DEACTIVATION FURNACE SYSTEM

Two banks of electric heaters provide sufficient heat to ensure that the material on the bucket conveyor is maintained at a temperature of 1000° F. The speed of the conveyor ensures the material is maintained at elevated temperature for at least 15 minutes to ensure decontamination of the material to the 5X level. A level of 5X indicates that the item is clean and may be released from government control without precautions or restrictions. The heated discharge conveyor discharges into a residue waste bin located inside the blast enclosure.

BLAST LOAD ATTENUATION DUCT

Because the DFS kiln is designed to process energetics that may result in a detonation, the exhaust duct leading from the kiln is equipped with a blast load attenuation duct outside of the DFS room. The exhaust duct prevents a large blast shock wave from reaching the pollution abatement system. The blast load attenuation duct consists of a short section of duct that is wider than the rest, within which are mounted several concentric baffle plates. The larger cross section of the attenuation duct combined with the baffle plates acts to dissipate any pressure wave from the kiln.

CYCLONE

The exhaust gas from the kiln enters the cyclone, a vertical cylindrical chamber with a tangential inlet near the top. The cyclone is designed to separate particulates from the flue gas stream going to the afterburner. Centrifugal force causes the particulates to travel to the side wall of the chamber where friction slows them and causes them to fall to the conical bottom. There they fall into a residue bin.

DFS AFTERBURNER

The DFS afterburner is a vertical, refractory-lined cylindrical chamber located just outside the pollution abatement system building. It has two fuel gas burners mounted at the top of the side wall. Exhaust gases from the DFS rotary kiln enter the furnace from the top, are heated by the burners to a temperature of 2150° F and exit from the side near the bottom. Combustion air and fuel gas enter the chamber through the burners. Figure 5-8 show a line diagram of the DFS.

INFORMATION SHEET 5-4-1 (Continued)
DEACTIVATION FURNACE SYSTEM

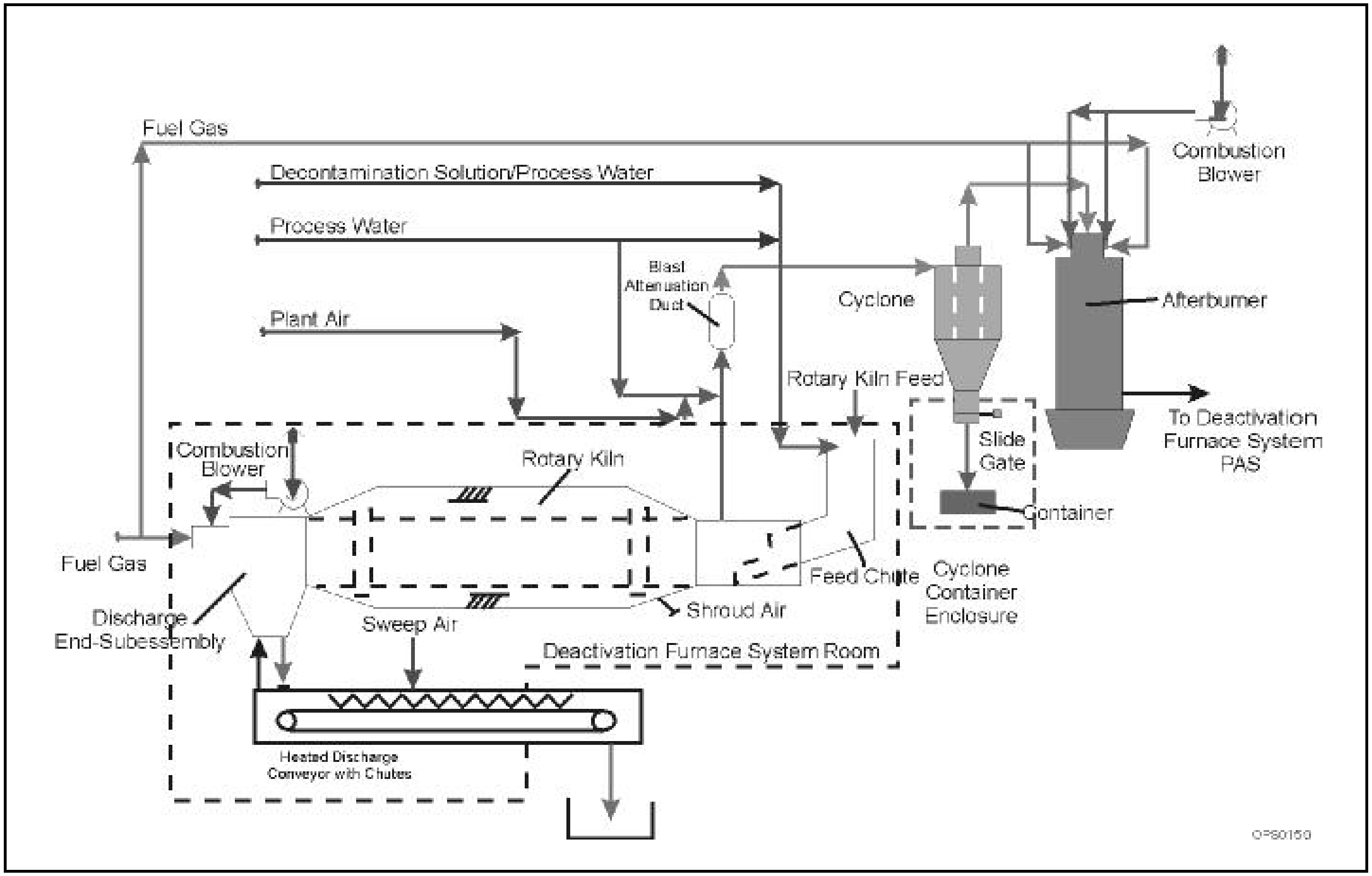

Figure 5-8: Deactivation Furnace System

OUTLINE SHEET 5-5-1
METAL PARTS FURNACE

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 5-5-1 “Metal Parts Furnace System”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Metal Parts Furnace.

    1.1 **IDENTIFY** the purpose of the Metals Parts Furnace.

    1.2 **IDENTIFY** the function of the following major components of the Metal Parts Furnace:

    - MPF Feed Conveyor/Airlock
    - Primary Furnace (MPF)
    - Afterburner
    - MPF Discharge Conveyor/Airlock
    - MPF Discharge Tray Unloading Conveyor
    - MPF Discharge Cooling Conveyor
    - MPF Combustion Air Blower

OUTLINE SHEET 5-5-1 (Continued)
METAL PARTS FURNACE

C. OUTLINE OF LESSON CONTENT

1. System Overview
2. Process Description/Major Components
    a. MPF Feed Conveyor/Airlock
    b. Primary Furnace (MPF)
        (1) Zone 1
        (2) Zone 2
        (3) Zone 3
    c. Afterburner
    d. MPF Discharge Conveyor/Airlock
    e. MPF Discharge Tray Unloading Conveyor
    f. MPF Discharge Cooling Conveyor
    g. MPF Combustion Air Blower

INFORMATION SHEET 5-5-1
METAL PARTS FURNACE

A. INTRODUCTION

This sheet provides information on the incineration process for residual liquid agent and munition bodies in the Metal Parts Furnace System.

B. REFERENCES

1. Programmatic Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The metal parts furnace (MPF) system (Figure 5-9) is used to thermally decontaminate:

- Drained Projectiles/Mortars
- Bulk Container Items
- Contaminated Mine Drums

The MPF is a batch-feed, conveyor furnace with three heating zones. Trays containing the material to be processed are passed through an entry airlock before being placed into the furnace. The following occurs in each zone:

- Zone 1 - Initial Heatup
- Zone 2 - Volitization & Combustion of Liquid Contents
- Zone 3 - Ensures 5X Decontamination

The tray then exits the furnace to an airlock, where it cools partially and is monitored with an Automatic Continuous Air Monitoring System device for any remaining agent contamination. From there, the tray exits the airlock to the exit conveyor. The exhaust from the MPF passes through an afterburner before it enters the MPF pollution abatement system.

INFORMATION SHEET 5-5-1 (Continued)
METAL PARTS FURNACE

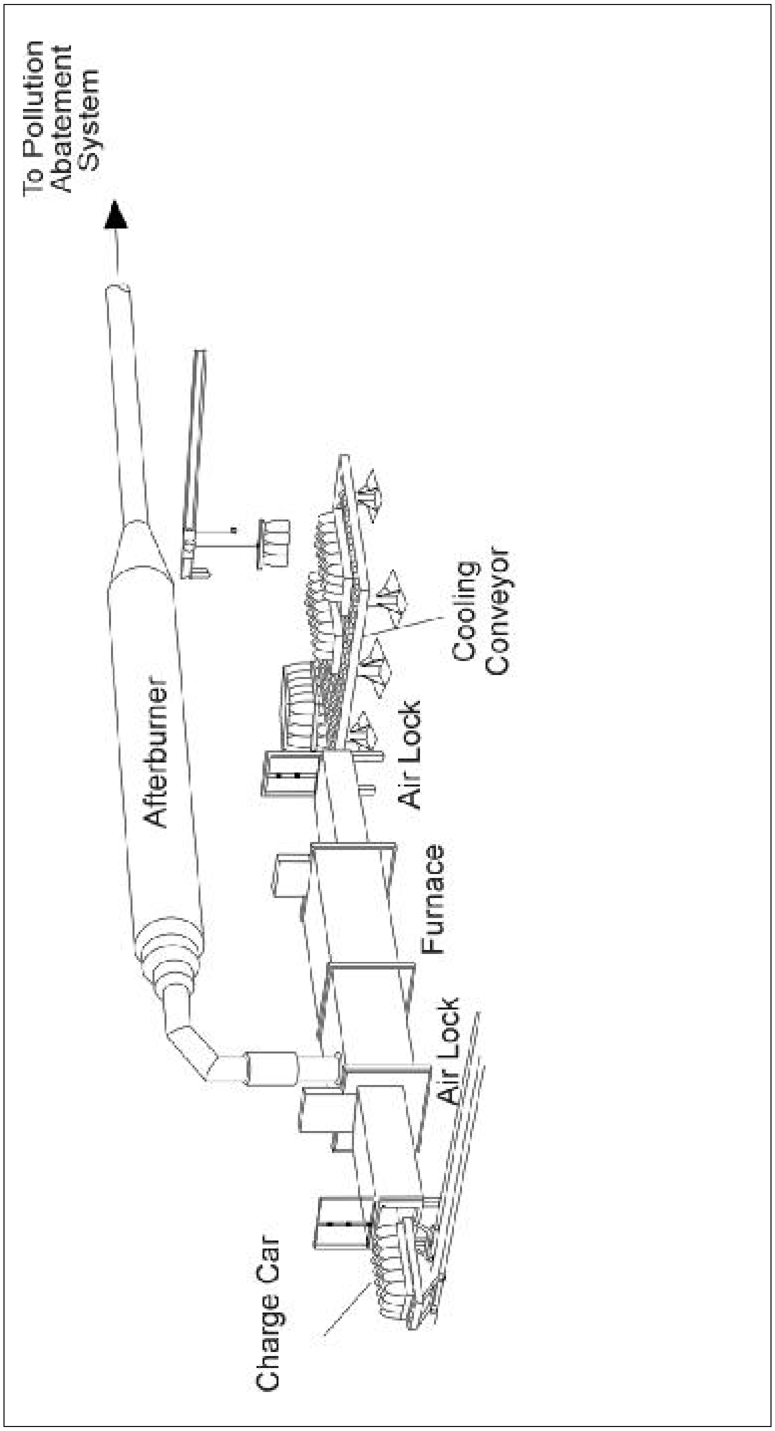

Figure 5-9: Process Overview of Metal Parts Furnace

INFORMATION SHEET 5-5-1 (Continued)
METAL PARTS FURNACE

2. PROCESS DESCRIPTION/MAJOR COMPONENTS

MPF FEED CONVEYOR/AIRLOCK

The MPF feed conveyor/airlock allows for the feeding of munitions and bulk items into the MPF while providing a physical boundary between the room and the MPF burner zones to contain heat and gases within the MPF. The MPF feed conveyor/airlock is a steel chamber with pneumatically actuated doors at each end, which encloses a powered roller conveyor.

PRIMARY FURNACE (MPF)

Thermal decontamination of munition bodies, mine drums and bulk items occurs in the MPF. The MPF is a horizontal, refractory-lined, carbon-steel enclosure approximately 42 feet long, 8 feet wide, and 10 feet high. One end of the MPF opens to the feed airlock and the other end opens to the discharge airlock. The MPF furnace length is divided into three burner zones.

Zone 1

Heatup of the load and initial burn of residual agent is accomplished. The MPF is operated at 1450° F for bombs and ton containers, 1525° F for spray tanks, and 1600° F for projectiles/mortars. While the load is in Zone 1, the conveyor oscillates to ensure even heating of the load and rollers. Heating of the load continues until a zone-specific cycle timer “times out”. The timer is preset to a prescribed value for the selected munition.

Zone 2

When the cycle timer times out, the zone 1 and zone 2 conveyors start in the forward direction in fast speed to transfer the load from zone 1 to zone 2. When the load is correctly positioned on the zone 2 conveyor, the zone 2 conveyor begins to oscillate and the zone 2 cycle timer begins to count down. Heat is supplied to zone 2 to maintain the same operating temperature as in zone 1. A new tray is transported to zone 1.

INFORMATION SHEET 5-5-1 (Continued)
METAL PARTS FURNACE

Zone 3

When the zone 2 cycle timer times out, the zone 2 and zone 3 conveyors start in the forward direction in fast speed to transfer the load to zone 3. When the load is in zone 3, the zone 3 conveyor begins to oscillate, and the zone 3 cycle timer begins to count down ensuring 5X requirements are met. A minimum of 1000° F for 15 minutes is needed to ensure detoxification of munition/bulk containers.

AFTERBURNER

The MPF system afterburner is a horizontal, cylindrical, refractory-lined chamber mounted directly above the MPF in the MPF system room. Exhaust flue gases from zone 1 of the MPF enter the bottom at one end of the afterburner and travels the horizontal length of the chamber, exiting at the other end into an exhaust duct. Two fuel gas burners are mounted near the afterburner inlet on the end wall. The exhaust gases are heated by the burner to a temperature of 2,000° F to ensure that any traces of agent carried over from the MPF in the flue gas are burned before reaching the MPF pollution abatement system.

MPF DISCHARGE CONVEYOR/AIRLOCK

The MPF discharge conveyor/airlock is an insulated steel chamber with pneumatically actuated doors at each end, enclosing a powered roller conveyor. This airlock allows the thermally decontaminated munition containers to be transported outside the MDB for cooling and disposal while maintaining a physical boundary between the MPF furnace area and the MDB exterior. One airlock door opens to the MPF and allows decontaminated metal parts trays to exit the MPF and enter the airlock. The other airlock door opens outside the MDB to the MPF discharge tray unloading conveyor.

The MPF discharge conveyor/airlock is similar to the MPF feed conveyor/airlock in operation. A major structural difference is that the discharge airlock is insulated while the feed airlock is not. Water cooling prevents the door mechanism from binding due to expansion of the airlock-side of the door when exposed to hot metal parts trays exiting the furnace.

INFORMATION SHEET 5-5-1 (Continued)
METAL PARTS FURNACE

After the MPF discharge conveyor/airlock inlet door is closed, the airlock is purged with air from the MPF room. This air purge cools down the munitions and tray in the airlock. The purged air is sampled for agent by an ACAMS monitor to ensure complete thermal decontamination has been achieved. Air flows from the MPF room, through the MPF discharge conveyor/airlock, to the ACAMS and is piped to the MPF afterburner. If the sample results are negative (no agent detected), the load is transferred out of the MPF discharge conveyor/airlock to the MPF discharge tray unloading conveyor. If agent contamination is detected, the tray must be transferred back into the MPF system for further processing.

MPF DISCHARGE TRAY UNLOADING CONVEYOR

The MPF discharge tray unloading conveyor transfers munition containers from the MPF discharge conveyor/airlock to the MPF discharge cooling conveyor. The purpose of the conveyor is to move a tray far enough away from the MDB for it to be moved perpendicularly by the discharge cooling conveyor.

MPF DISCHARGE COOLING CONVEYOR

The MPF discharge cooling conveyor allows the trays containing decontaminated metal parts waste to cool and provides a temporary storage area for the metal parts until they are disposed of or transported to the munition mutilation system.

MPF COMBUSTION AIR BLOWER

The MPF Combustion Air Blower supplies combustion air to the MPF and the MPF Afterburner. Combustion air is supplied to each of the burners in the MPF System for pilot flame and the main burner flame. Combustion air to the burners in primary chamber is maintained at a fixed flow and burner fuel input is varied through a temperature controller. This ensures the proper fuel gas to combustion air ratio is maintained at each burner. Combustion air is also used to cool the burner flame scanners. To view the MPF system, see Figure 5-10.

INFORMATION SHEET 5-5-1 (Continued)
METAL PARTS FURNACE

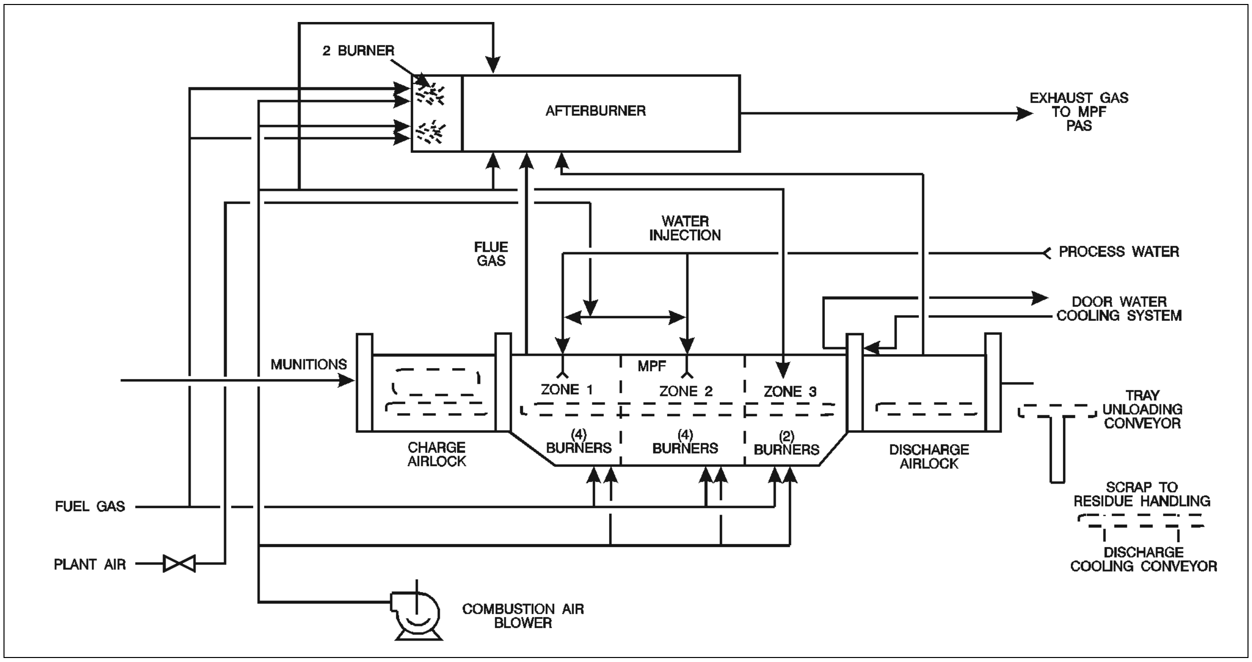

Figure 5-10: Metal Parts Furnace System

LESSON TOPIC 5.6: DUNNAGE INCINERATOR SYSTEM

TOPIC OBJECTIVES

1. Dunnage Incinerator System(pgs. 197-202) material removed with Change 3.

OUTLINE SHEET 5-7-1
POLLUTION ABATEMENT SYSTEMS

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 5-7-1 "Pollution Abatement Systems".

B. LESSON OBJECTIVES

1. **DESCRIBE** the Wet Pollution Abatement Systems.

   1.1 **IDENTIFY** the purpose of the Wet Pollution Abatement Systems.

   1.2 **IDENTIFY** the function of the following major components of the Wet Pollution Abatement Systems:

   - Quench Tower
   - Venturi Scrubber
   - Packed-Bed Scrubber Tower
   - Mist Eliminator
   - Exhaust Blower

2. Dry Pollution Abatement System material removed.

OUTLINE SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Wet Pollution Abatement System

   a. Process Description/Major Components

      (1) Quench Tower

         (a) Quench Brine

      (2) Venturi Scrubber

      (3) Packed-Bed Scrubber Tower

         (a) Sump

         (b) Chimney Tray

         (c) Packed Bed

         (d) Distribution Tray

         (e) Mist Eliminator Pad

      (4) Mist Eliminator

      (5) PAS Filter System

         (a) Exhaust Gas Conditioning

         (b) Carbon Filtration

      (6) Exhaust Blower

INFORMATION SHEET 5-7-1
POLLUTION ABATEMENT SYSTEMS

A. INTRODUCTION

This sheet provides information on the systems that are used to treat the exhaust gases from the furnace systems.

B. REFERENCES

1. TOCDF Functional Analysis Workbook

2. Programmatic Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

Each incinerator/furnace is equipped with its own wet pollution abatement system. The wet system performs the following functions:

- Cools exhaust gases
- Chemically neutralizes acidic portions of the gases
- Removes particulates

The metal parts furnace, liquid incinerator, and deactivation furnace use a wet pollution abatement system.

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

2. WET POLLUTION ABATEMENT SYSTEM

The wet pollution abatement system (PAS) cools and chemically treats the exhaust gas from the furnace, reducing the emission of pollutants to environmentally acceptable levels. The PAS processes the exhaust gases, which flow directly from the furnace. The gases, cooled and scrubbed by the PAS, are discharged into a stack that is common to all wet pollution abatement systems. The brine produced by the PAS is pumped to the Brine Reduction Area. The PAS requires process water and 18% weight sodium hydroxide. Each wet PAS (Figure 5-13) consists of the following:

- Quench Tower
- Venturi Scrubber
- Packed Bed Scrubber Tower
- Mist Eliminator
- PAS Filter System (Not applicable at all sites)
- Exhaust Blower

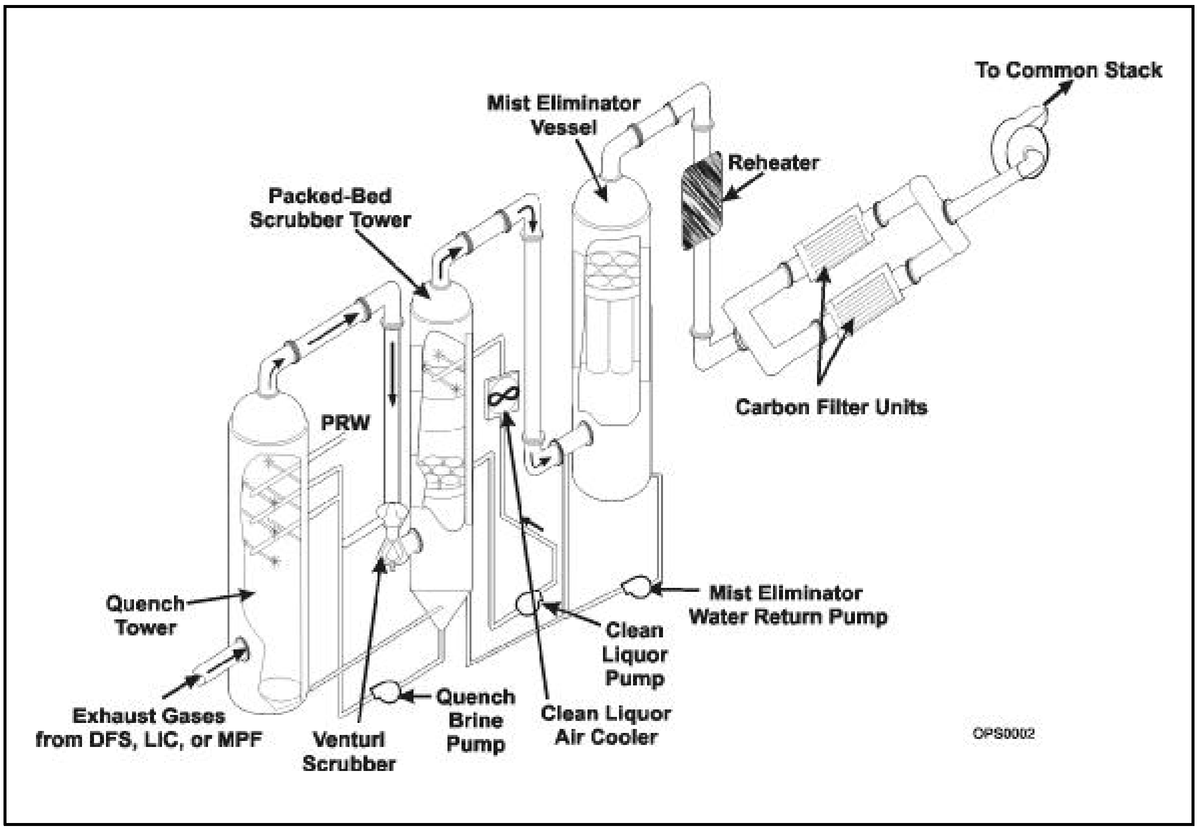

Figure 5-11: Wet Pollution Abatement System

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

PROCESS DESCRIPTION/MAJOR COMPONENTS

Quench Tower

The first step in each PAS is treatment of the furnace flue gases in a counter flow quench tower. The quench tower is a Hastelloy vertical vessel that contains multiple banks of spray nozzles. High temperature (~2000°F) furnace flue gases enter near the bottom of the quench tower through a refractory-lined inlet nozzle. The gases flow up through the caustic mist created by the sprays and are cooled nearly to their saturation temperature as water is evaporated. A process water line is attached to a dedicated set of quench nozzles that is used for emergency quench in the event of a high temperature condition. Exhaust gases and vapors exit the top of the quench tower. Unevaporated liquid brine falls to the bottom of the quench tower, where it drains by gravity into the bottom of the scrubber tower sump. See Figure 5-14

Quench Brine - Quench brine is constantly recirculated by a quench brine pump from the scrubber tower sump to the lower two sets of spray bank nozzles in the quench tower and to the radial and tangential spray nozzles at the entrance to the venturi scrubber. The system uses two pumps: one pump is designated as primary by the control room operator. If the primary pump malfunctions or if pressure is lost, the standby pump is automatically started and the primary pump is stopped.

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

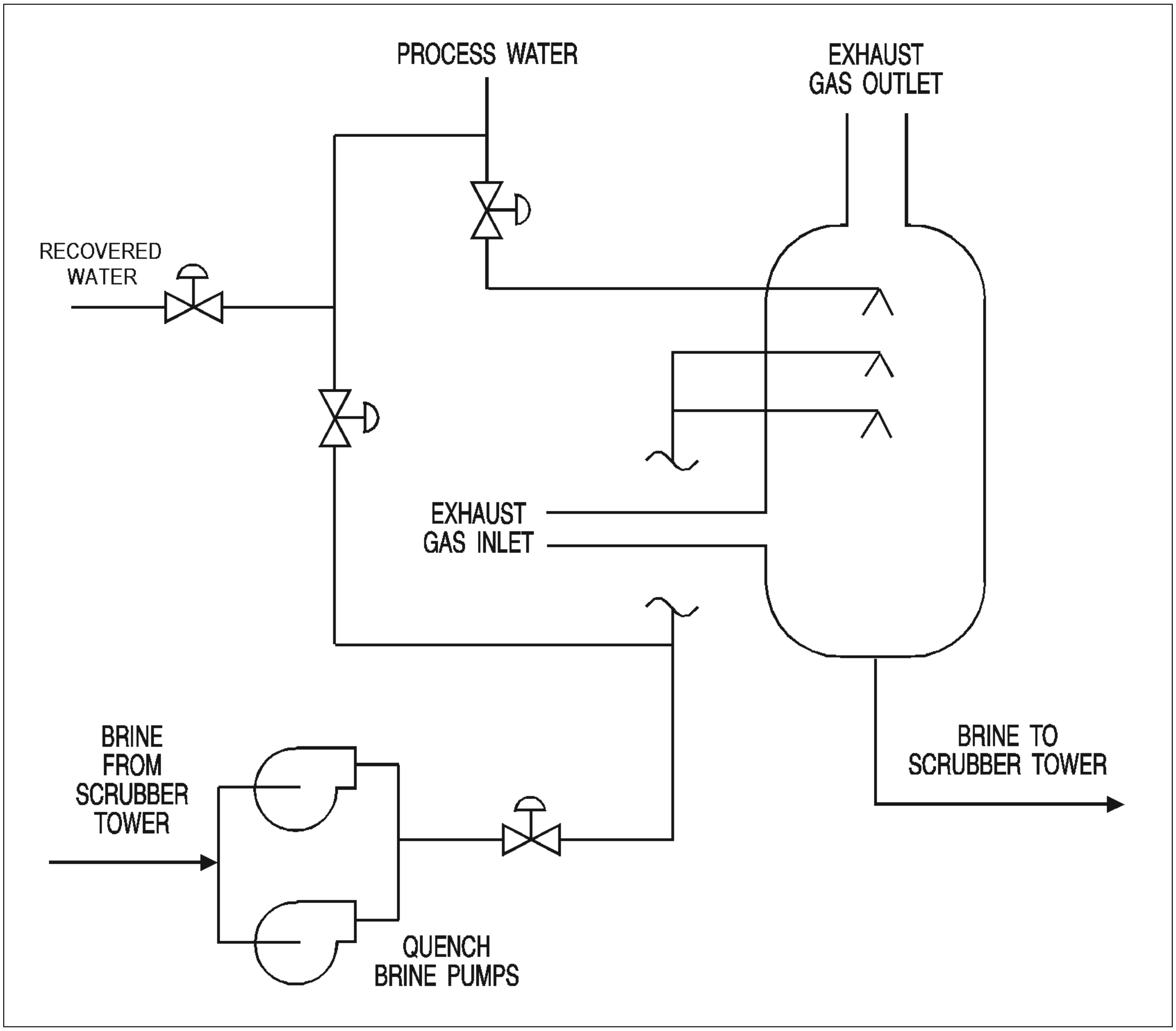

Figure 5-12: Quench Tower

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

Venturi Scrubber

The venturi scrubber removes particulate matter (99% efficiency for particles 0.5 micron or larger) and acid gases from the quenched furnace exhaust. The venturi scrubber is a Hastelloy, variable-plug throat venturi, with multiple radial and tangential caustic brine spray nozzles at its inlet. Exhaust gases cooled in the quench tower flow down through the venturi scrubber where they encounter radial and tangential sprays of caustic brine. The spray nozzles are used to mix brine solution with the flue gas as it enters the venturi scrubber. The caustic brine droplets further react with acid gases, and the moisture entraps fine solid particulates. The exhaust flue gas and liquid streams combine and are accelerated to high velocity in the decreasing area of the throat of the venturi. The high velocity, combined with a 90 degree change in direction, causes the removal of particulates from the gas. See Figure 5-15.

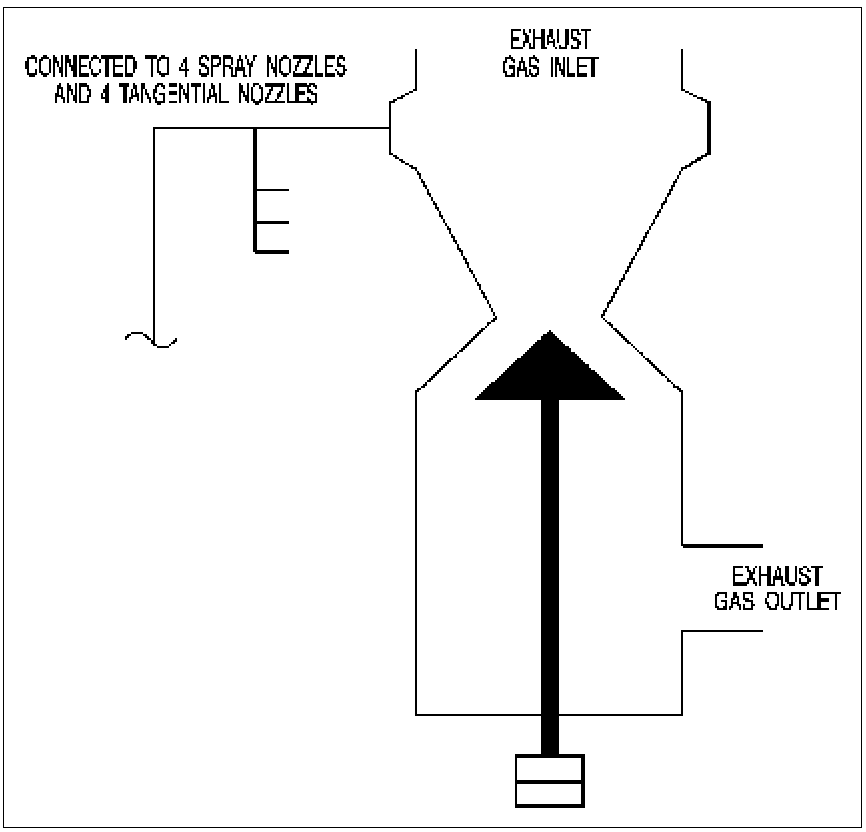

Figure 5-13: Venturi Scrubber

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

Packed-Bed Scrubber Tower

The packed-bed scrubber tower (Figure 5-16) is a counter-current system that scrubs the remaining acids out of the flue gas stream. At sites which have a PAS Filter System, the scrubber tower also serves as a counter-current heat exchanger that cools the up-flowing gases in the packed bed. The scrubber tower is a vertical Hastelloy vessel with internals that include:

- Sump
- A Chimney Tray
- Packed Bed
- Distribution Tray
- Mist Eliminator Pad

The stream from the venturi scrubber enters the scrubber tower through a tangential (rectangular) nozzle near the bottom of the tower. The gas portion of the stream flows up through the tower while the entrained liquid droplets fall to the bottom or sides of the tower. Exhaust gases exit at the top of the scrubber tower.

Sump - The quench brine liquid that is used at the quench tower and venturi scrubber is stored in the scrubber tower sump.

Chimney Tray - The gases that enter the scrubber tower flow upward through a chimney tray. The purpose of the chimney tray is to maintain separation of the brine liquid recirculated to the quench tower and venturi scrubber from the clean liquor sprayed on the packed bed. The brine solution from the quench tower and venturi scrubber contains suspended solids, which could cause plugging in the packed bed.

Packed Bed - The exhaust gas continues through the packed bed. In the packing, the flue gas is exposed to caustic from the clean liquor solution. The packed bed provides a large surface area for the flue gas to come in contact with the clean liquor. The packed bed also forces the flue gas to take a tortuous path to provide good mixing of the flue gas with the clean liquor. Clean liquor that drains out of the packed bed is collected in the chimney tray, where it is recirculated to the top of the packed bed.

Distribution Tray - Clean liquor is sprayed over the top of the packed bed and distributed over the packing (pall rings) by a distribution tray.

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

Mist Eliminator Pad - A mist eliminator pad at the top of the scrubber tower is used to strip any excess moisture that may have been entrained in the flue gas flow. A process water spray line is directed at the bottom of the demister pad, and can be used to rinse the demister pad as the differential pressure increases.

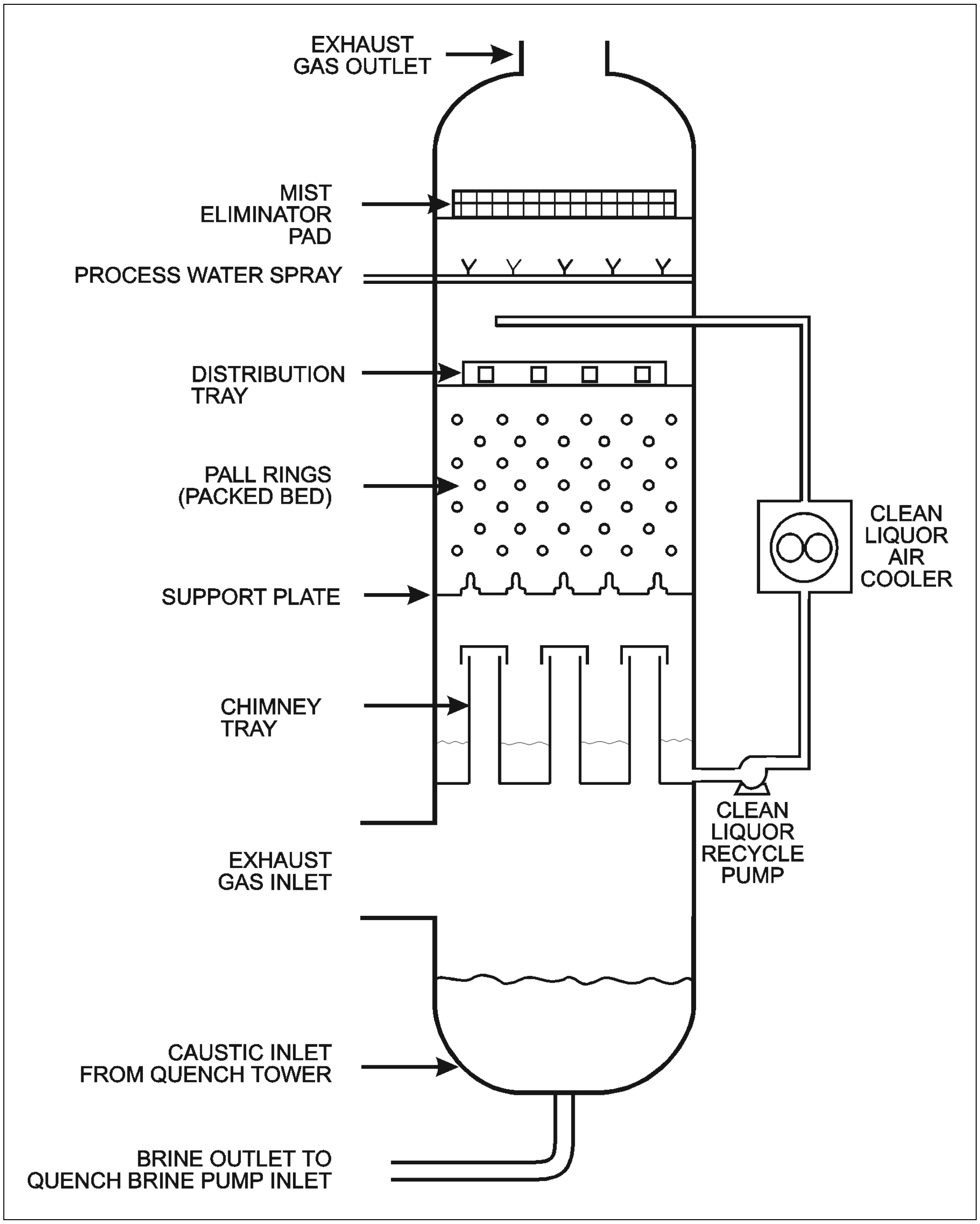

Figure 5-14: Scrubber Tower

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

Mist Eliminator

The mist eliminator (sometimes referred to as “demister”) is the last stage of the pollution abatement system “cleansing” process (Figure 5-17). The mist eliminator is a fiberglass, flat-bottom, domed-top vessel with multiple vertically-mounted filter elements (called candles). The candles remove H_3PO_4 (orthophosphoric acid), metal oxides, and other entrained solid and liquid particulates from the gas stream.

Entrained liquids form droplets on the candles; these drops then move by gravity to the sump. Water-soluble particulates embedded in the candle are dissolved by these droplets and are also carried to the sump. Non-soluble particles on the filter may also be suspended by the flowing liquid and carried to the sump. Non-soluble particles which become embedded in the filter material will not be washed down, and will eventually necessitate replacement of the candle packing.

A mist eliminator water return pump is provided to pump the liquid collected in the mist eliminator to the scrubber tower sump.

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

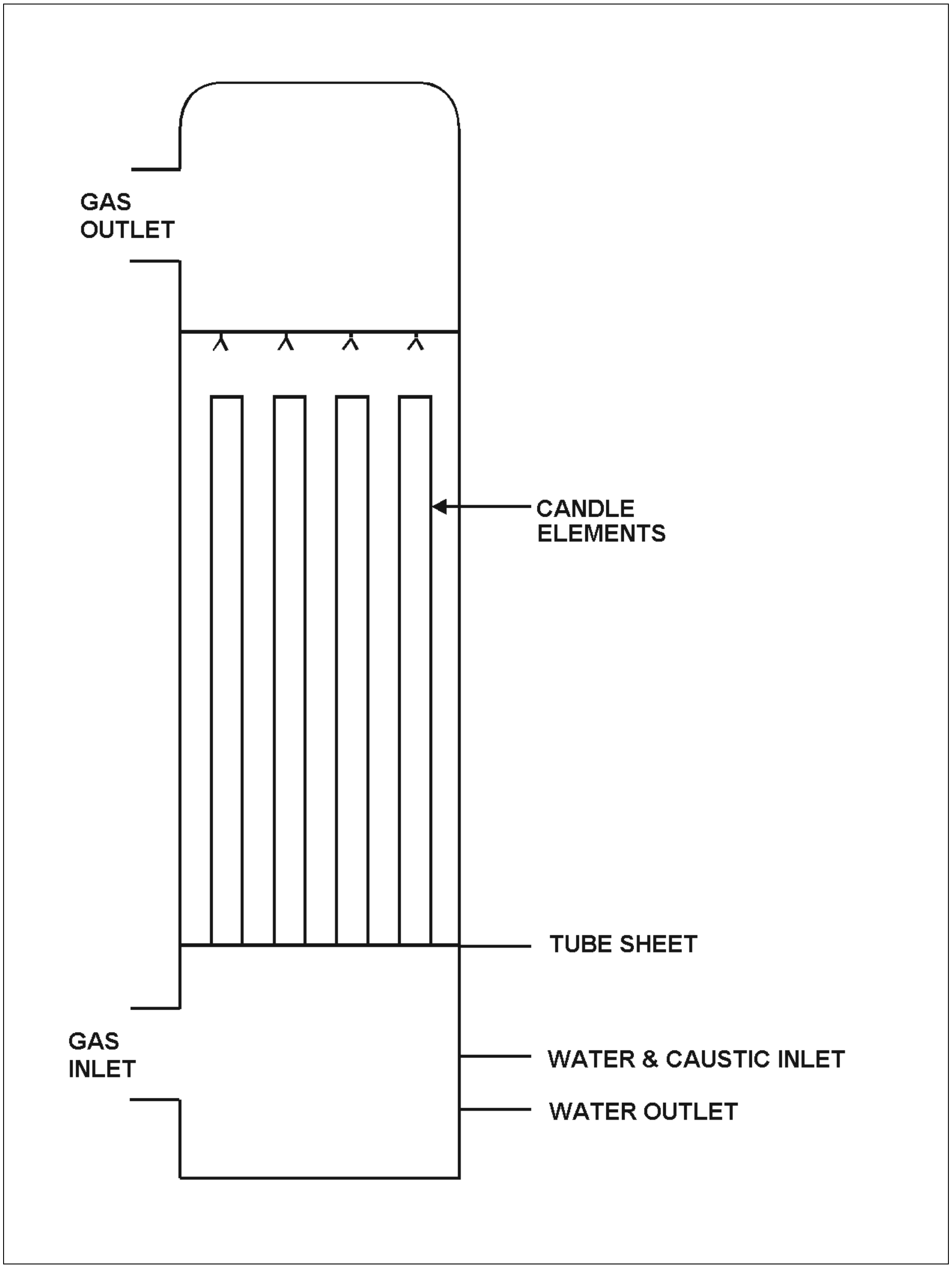

Figure 5-15: Mist Eliminator

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

PAS Filter System

At some sites, there has been an addition to the Pollution Abatement System called the PAS Filter System. This system removes trace levels of organic compounds and particles from the flue gas. It also ensures that agent is adsorbed by the carbon filters and prevented from being discharged to the atmosphere in the unlikely event that chemical agent is released through the PAS. To accomplish this, the PAS Filter System consists of the following equipment:

- Exhaust Gas Conditioning
- Carbon Filtration

Exhaust Gas Conditioning - The exhaust gas conditioning section of the PAS Filter System requires that the scrubber tower clean liquor be cooled to below 120°F. The cooled clean liquor in turn cools the scrubber tower exhaust gas to condense moisture out.

After the exhaust gas is cooled in the scrubber tower and some of the water vapor is condensed, the exhaust gas exits the scrubber tower and mist eliminator vessel saturated with water vapor (100% relative humidity). The gas is reheated by an in-line gas reheater unit to reduce the relative humidity so that condensation will not occur within the carbon filter units and block the adsorption sites.

Carbon Filtration - The carbon filter units receive conditioned exhaust gas from the gas reheater at approximately 160°F with a relative humidity of less than 55%. The carbon filter units remove the trace agent or organic vapors from the exhaust in the unlikely event that they are present because of furnace upset conditions.

Exhaust Blower

The exhaust blower is the motive force of flow through the entire furnace and furnace PAS. Upstream of the exhaust blower inlet is a pressure-control damper, which is controlled by a signal from the furnace. This damper responds to a pressure controller to maintain the pressure in the furnace chamber at a constant negative value. Figure 5-18 shows a line diagram of the wet pollution abatement system.

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

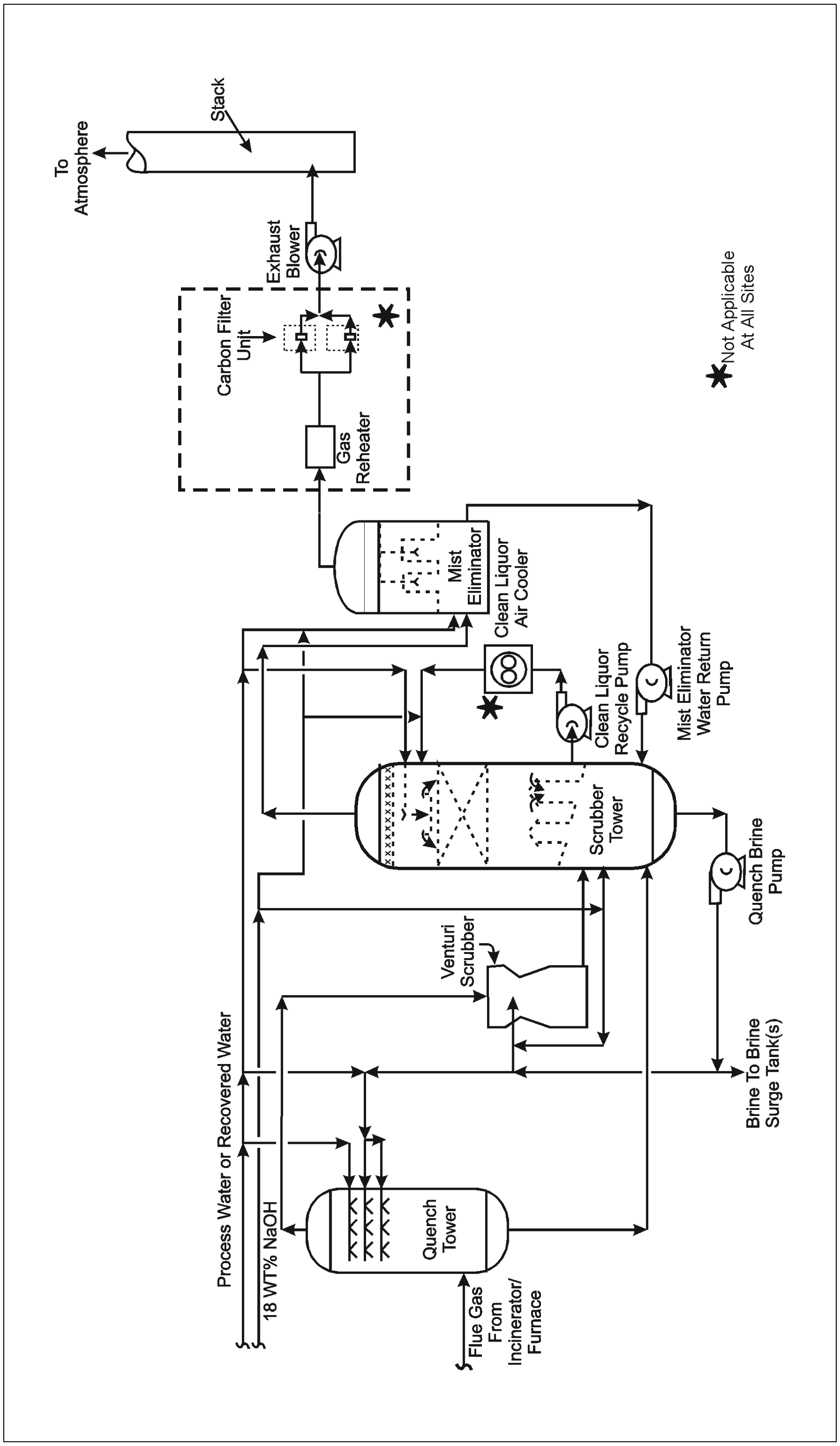

Figure 5-16: Wet Pollution Abatement System

INFORMATION SHEET 5-7-1 (Continued)
POLLUTION ABATEMENT SYSTEMS

3. Dry Pollution Abatement System(pgs 216-218) material removed during Change 3.

UNIT 6: WASTE PROCESSES

OUTLINE SHEET 6-1-1
BRINE REDUCTION AREA

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 6-1-1 “Brine Reduction Area”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Brine Reduction Area System.

   1.1 **IDENTIFY** the purpose of the Brine Reduction Area System.

   1.2 **IDENTIFY** the function of the following major components of the Brine Reduction Area System:

   - Brine Surge Tanks
   - Brine Feed Pumps
   - Evaporator Package
   - Drum Dryer Package

2. **DESCRIBE** the Steam Generation System.

   2.1 **IDENTIFY** the purpose of the Steam Generation System.

   2.2 **IDENTIFY** the function of the following major components of the Steam Generation System:

   - Boiler Package
   - Deaerator Package
   - Chemical Feed System
   - Condensate Return System

OUTLINE SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

3. **DESCRIBE** the Brine Reduction Area Pollution Abatement System.

   3.1 **IDENTIFY** the purpose of the Brine Reduction Area Pollution Abatement System.

   3.2 **IDENTIFY** the function of the following major components of the Brine Reduction Area Pollution Abatement System:

   - Air Heater
   - Dryer Knockout Box
   - BRA PAS Burner
   - BRA PAS Baghouses
   - BRA PAS Exhaust Blower
   - BRA PAS Stack

C. OUTLINE OF LESSON CONTENT

1. System Overview

2. Process Description/Major Components

   a. Brine Reduction Area Systems

      (1) Brine Surge Tanks

      (2) Brine Feed Pumps

      (3) Evaporator Package

         (a) Flash Evaporator

         (b) Brine Recirculation Pumps

         (c) Brine Heat Exchanger

      (4) Drum Dryer Package

OUTLINE SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

b. Steam Generation System

(1) Boiler Package

(2) Deaerator Package

(3) Chemical Feed System

(a) Phosphate

(b) Sulfite

(c) Amine

(4) Condensate Return System

c. Brine Reduction Area Pollution Abatement System

(1) Air Heater

(2) Dryer Knockout Box

(3) BRA PAS Burner

(4) BRA PAS Baghouses

(5) BRA PAS Exhaust Blower

(6) BRA PAS Stack

INFORMATION SHEET 6-1-1
BRINE REDUCTION AREA

A. INTRODUCTION

This sheet provides information on the Brine Reduction Area and all associated systems.

B. REFERENCES

1. Programmatic Functional Analysis Workbook
2. ANCDF Functional Analysis Workbook
3. TOCDF Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The function of the Brine Reduction Area (BRA) is to process brine from the scrubbers of the pollution abatement systems and from the water treatment system. The brine is stored in the brine surge tanks, where it is sampled and checked for agent presence. From there, it proceeds to the brine evaporator, which removes a significant amount of water and prepares the brine for drying. The brine is sent to the drum dryers, which reduce the brine to a dried salt, and deposit the salt into containers for storage and transportation offsite. Figure 6-1 shows the brine reduction area system.

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

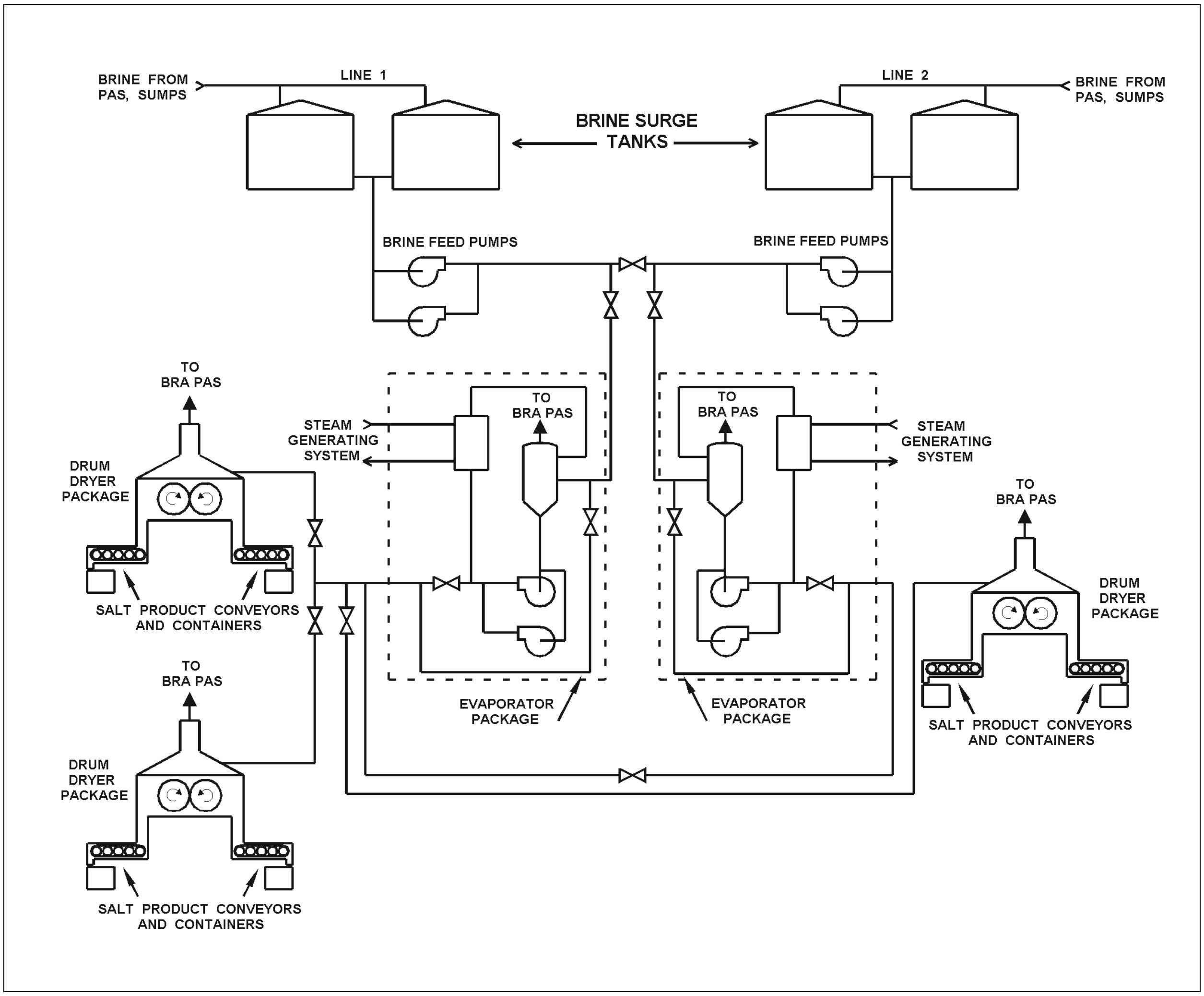

Figure 6-1: Brine Reduction Area Systems

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

2. PROCESS DESCRIPTION/MAJOR COMPONENTS

BRINE REDUCTION AREA SYSTEMS

Brine Surge Tanks

The brine surge tank acts as a holding tank, which enables the brine from the pollution abatement systems to be sampled before it is sent to be dried. This is the final checkpoint in the process for the presence of residual agent. Each surge tank has an agitator protruding into the tank through the sidewall. The agitator is required for two reasons: (1) to ensure that the sample of the tank contents is a representative one from the well-mixed batch and (2) to keep suspended any salts that normally precipitate from brine solutions.

Brine Feed Pumps

The brine feed pumps transfer brine from the brine surge tanks to the brine evaporators. These pumps are made of a chrome nickel alloy to resist the corrosive effects of the brine they pump.

Evaporator Package

Each evaporator package consists of a brine heat exchanger, a brine flash evaporator, and two brine circulation pumps. Brine from the brine feed pumps can be processed through the evaporator to improve performance of the drum dryers, or the evaporator can be bypassed and the brine sent directly to the drum dryers. Pollution abatement system brine from VX processing will go directly to the drum dryers due to the higher density solution. Water treatment system waste will also normally go directly to the drum dryers because of the high magnesium and calcium concentrations that are less compatible with the heat exchanger design. All other brine will normally be processed in the evaporator.

Flash Evaporator - The evaporator is a vertical vessel with a conical bottom and has a total volume of approximately 1,000 gallons. Here the brine that has been heated returns from the heat exchanger and flashing occurs, thus driving off water. Brine from the feed pumps are combined with the brine exiting the flash evaporator bottom.

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

Brine Recirculation Pumps - Each evaporator package includes two brine recirculation pumps, one operating and one spare. The pumps are identical and rated at approximately 945 gpm. Brine flow to the drum dryers is drawn from the recirculation pump discharge.

Brine Heat Exchanger - Brine flows from the recirculation pump to the heat exchanger. The heat exchanger raises the temperature of the brine from the surge tanks to about 250°F using steam. This temperature increase allows the evaporation process to occur when the brine reaches the flash evaporator.

Drum Dryer Package

Each drum dryer package consists of two rotating drums approximately 42 inches in diameter and 12 feet. long. One drum is anchored and the other is adjustable to allow setting the desired distance between the drums. This separation is optimally set at 1/8". The drums rotate towards the center of the dryer and are arranged in a “nip feed” configuration. The nip is the volume of liquid held between the two drums and the end boards. The nip contains up to 120 gallons of liquid at a depth of four inches. Steam flows through the interior of the drums and the heat transferred results in a film of dried salt deposit on the drums as they rotate. Knife blades on the outside of the drums scrape off the salt film, which drops to a conveyor belt running the length of each drum. At the end of each conveyor, the salt falls into a container that is removed periodically to the residue handling area for disposal. Figure 6-2 show an illustration of a drum dryer.

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

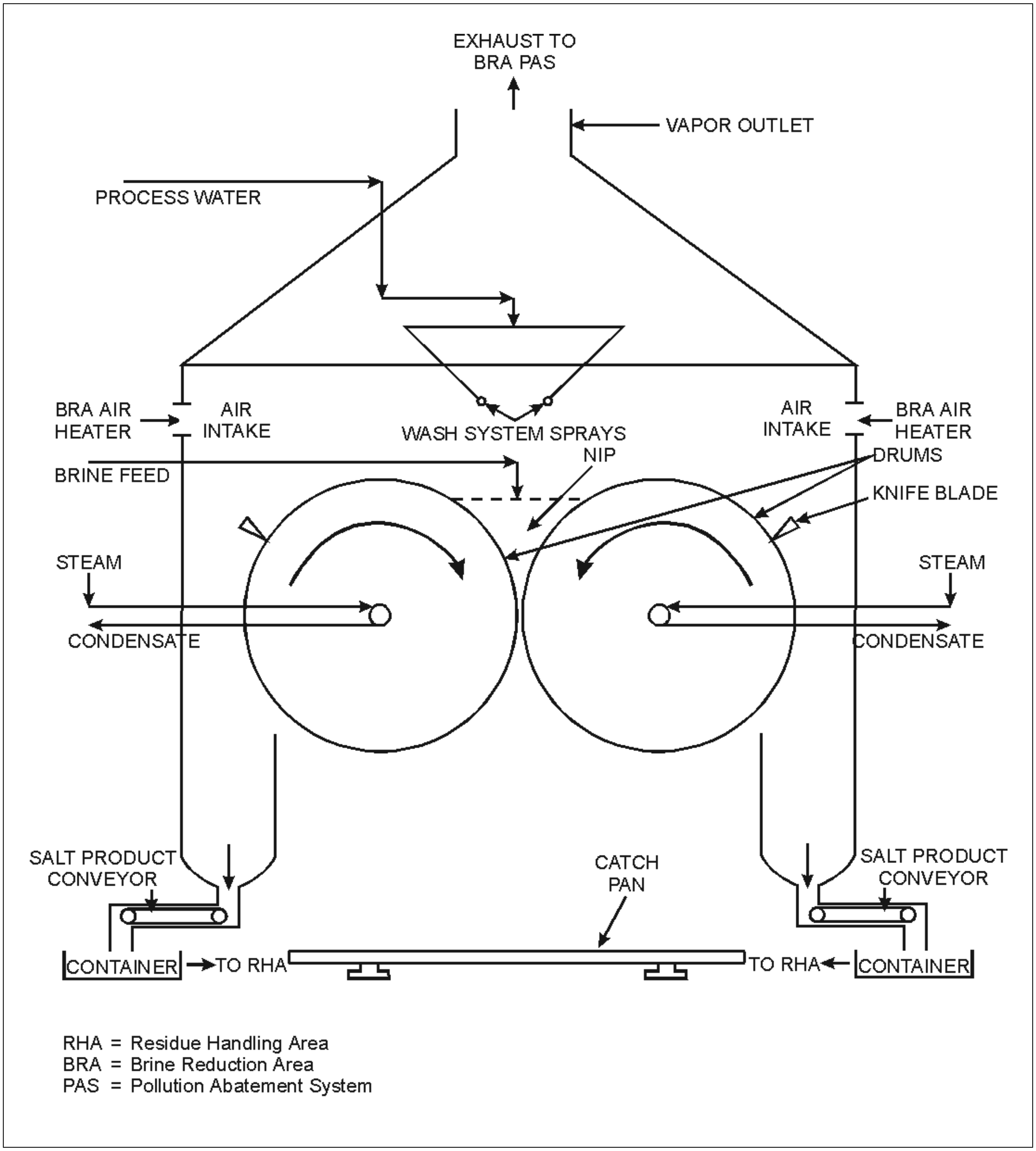

Figure 6-2: Drum Dryer

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

STEAM GENERATION SYSTEM

The purpose of the steam generation system (Figure 6-3) is to provide high-pressure steam for use in the drum dryers and evaporator in the brine reduction area. The steam generation system consists of:

- Two Boiler Packages
- Deaerator Package
- Three Chemical Feed Packages
- Two Steam Condensate Return Packages

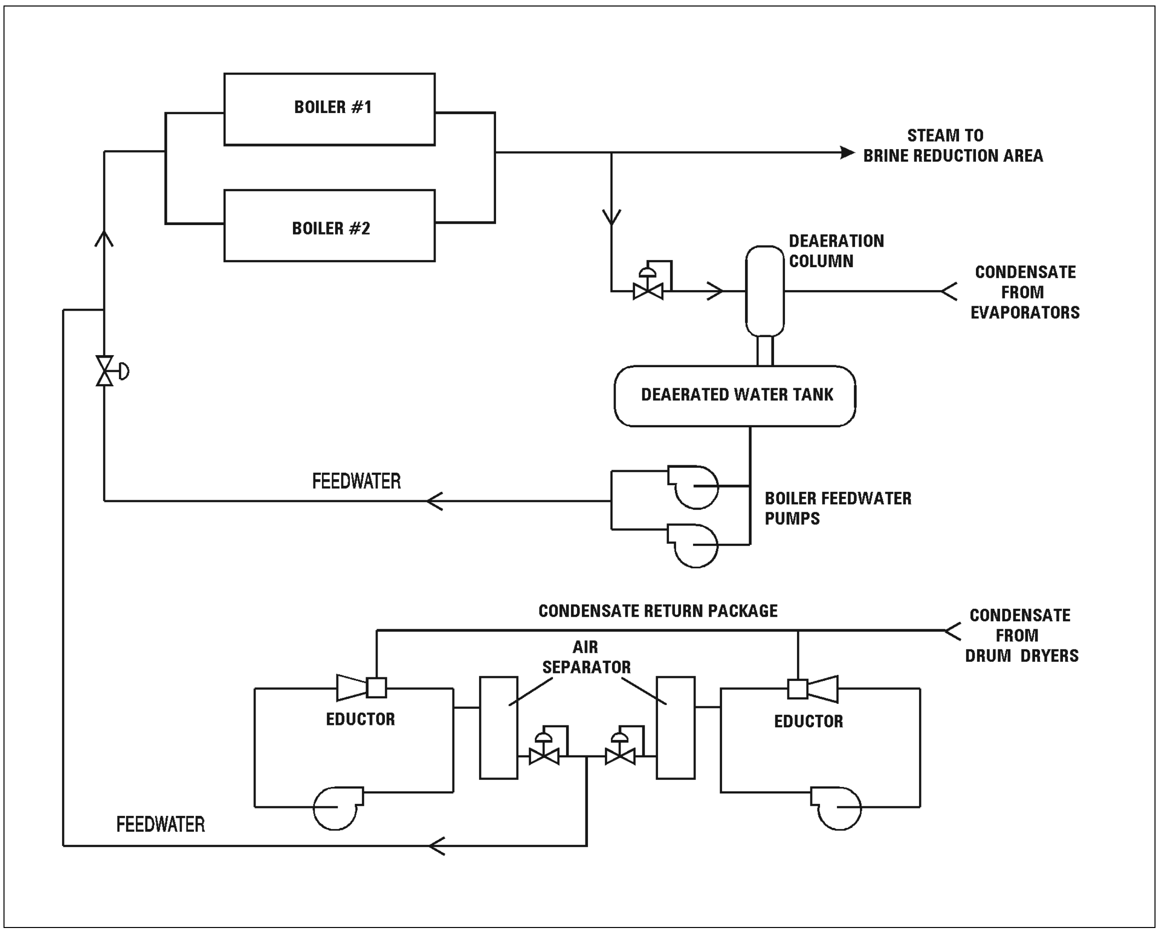

Figure 6-3: Steam Generation System

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

Boiler Package

The boiler package consists of two similar boiler units which have common feedwater and steam supply headers. The boilers convert feedwater to steam that is used to operate equipment in the brine reduction area.

Deaerator Package

Process water makeup and low-pressure condensate are fed through a deaerator before being sent to the boilers to reduce the non-condensibles introduced to the system. The deaerator package consists of:

- Deaeration Column
- Deaerated Water Tank
- Boiler Feedwater Pump with Associated Standby Pump

Process water and low-pressure condensate enter the deaeration column and flow counter currently to the steam from the boiler. The steam heats the water to its saturation temperature, releasing any dissolved gases. The gases are vented continuously at the top of the column. The heated water drops to the deaerated water tank.

Chemical Feed System

The chemical feed system (Figure 6-4) supplies water treatment chemicals to the steam generation system to minimize corrosion of components. The system consists of three chemical feed packages.

Phosphate - Phosphate is fed from one of the feed packages to the boiler feedwater. Phosphates remove any calcium ions (hard scale) present in the boiler water and turns it into a soft sludge to prevent fouling of heat transfer surfaces. The soft sludge is then removed by performing boiler blowdowns.

Sulfite - Sulfite is fed from a second feed package to the deaerator. Sulfite is used to remove oxygen in the feedwater and boiler water.

Amine - Amine is used for pH control to minimize corrosion in steam, feed, and condensate. It is fed from the third feed package to the steam supply header. Since amine is volatile, it will be entrained with the steam, reducing corrosion in steam and condensate piping.

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

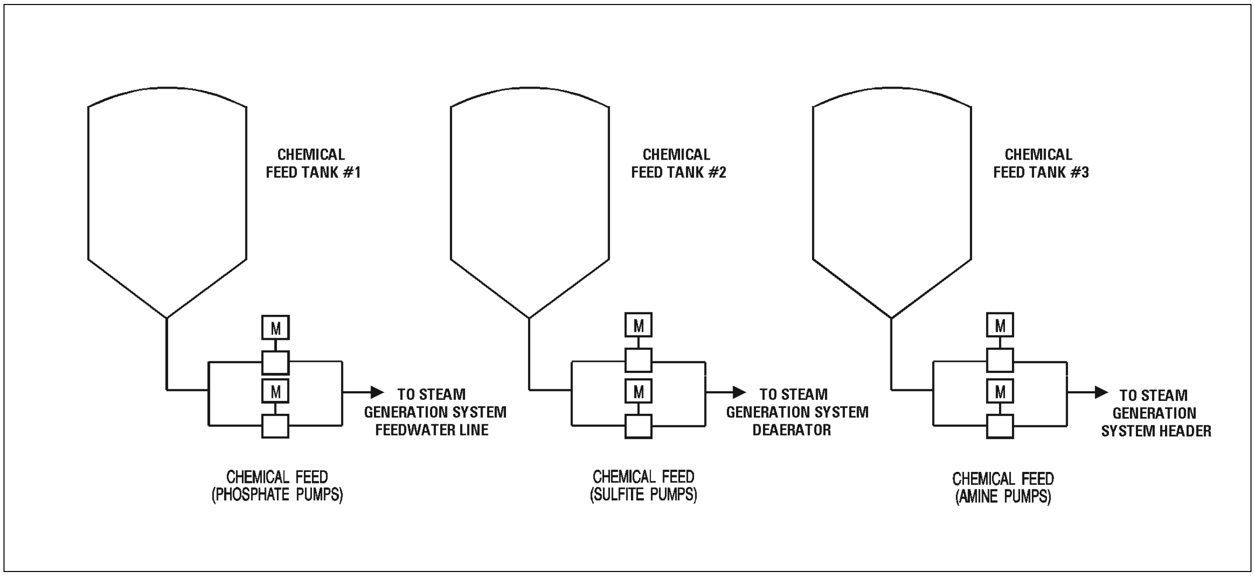

Figure 6-4: Chemical Feed System

Condensate Return System

The condensate return system consists of two steam condensate drain pump units that receive high-pressure condensate from the drum dryers and return it directly to the boilers. Each unit consists of a/an:

- Pump
- Eductor
- Air Separator
- Differential Pressure Control Valve

The pump circulates condensate through the eductor and back to the pump suction. The action of the eductor draws additional condensate from the drum dryers into the recirculation loop. Condensate is drawn from the pump discharge through the air separator. Air and non-condensibles are vented at the top of the air separator through an auto air vent. The differential pressure control valve (downstream of the air separator) maintains discharge pressure by reducing flow out of the system when the pump discharge pressure decreases due to less condensate being received from the drum dryers.

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

BRINE REDUCTION AREA POLLUTION ABATEMENT SYSTEM

The Brine Reduction Area Pollution Abatement System (BRA PAS) collects contaminates from the evaporator packages and drum dryers. During operation of the Brine Reduction System, steam is generated as the brine solution is reduced to a dry salt product. As the water in the brine vaporizes, salt becomes entrained with the steam exiting the Brine Evaporator and Drum Dryer Packages. The Brine Reduction Area Pollution Abatement System removes the salt particles from the steam prior to being exhausted to the atmosphere. See Figure 6-5.

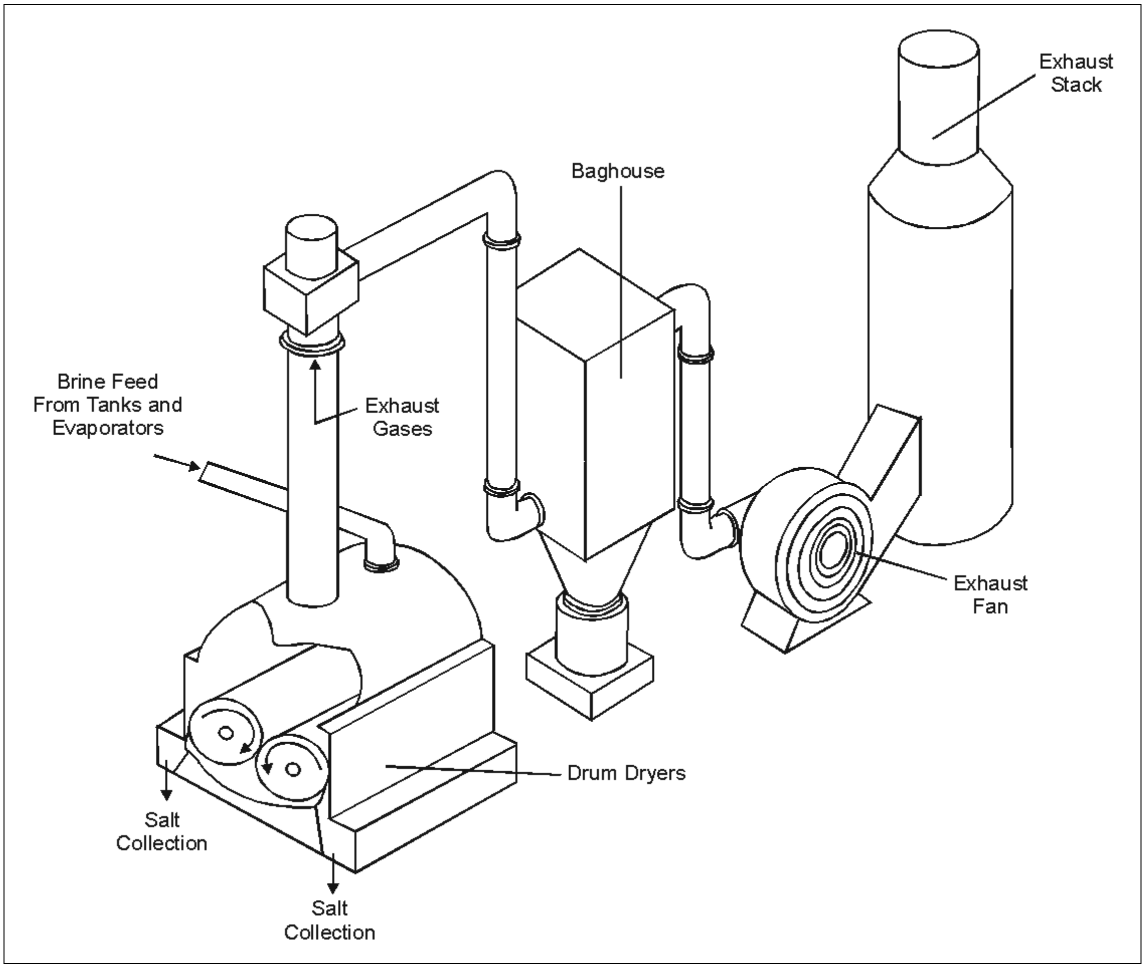

Figure 6-5: Overview of Brine Reduction Area Pollution Abatement System

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

The Brine Reduction Area Pollution Abatement System consists of:

- Air Heater
- Dryer Knockout Box
- BRA PAS Burner
- BRA PAS Baghouses
- BRA PAS Exhaust Blower
- BRA PAS Stack

The BRA PAS is considered to be a "dry system" since salt particles are physically separated by using a knockout box and filters. See Figure 6-6.

Air Heater

The BRA Air Heater supplies heated air to the Drum Dryers to replace the air being induced through the BRA PAS Exhaust Blower. This additional source of air allows the operation of the BRA PAS to continue without affecting the heating within the Process and Utilities Building. Operation of the BRA PAS Exhaust Blower without a BRA Air Heater would increase the flow of room air into the Drum Dryers and cause a higher volume of outside air to enter into the Brine Reduction Area. The cooling effect caused by this additional air flow surpasses the heating capacity of the HVAC Hot Water Heating System. When the Drum Dryers receive the cold air, undesirable condensation of the moisture begins to occur in the BRA PAS. In order to maintain the temperature requirements of the air inside the building, a secondary source of heated outside air is required.

Dryer Knockout Box

The process gases from each drum dryer are separately directed to the knockout box. At the knockout box, the gas stream is slowed to allow the heavier particulate and water condensation to leave the flow. The particulates and condensation are discharged through the knockout box hopper rotary airlock and flexible connector to a seal container. The knockout box is heated to reduce moisture condensation. Two vibrators keep the salt from sticking to the sides, and a rotary valve that drops salt into a salt container beneath the knockout box. As the gas stream leaves the knockout box, the velocity is increased to prevent any particulate form building up on the inside of the piping.

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

BRA PAS Burner

The exhaust gases from the drum dryers are combined in the knockout box and are routed to the direct fired BRA PAS gas burner. The temperature of the dryer exhaust is raised to 250 °F by the burner. After exiting the burner, the drum dryer gases merge with the moisture-laden gases from the evaporators. The drum dryer gases are heated to prevent condensation in the system.

BRA PAS Baghouses

The gas stream is drawn into the baghouse modules. Each baghouse contains 210 filters with a filter efficiency of 99.99% for particulate greater than 0.3 microns. When the pressure drop across the bag reaches four inches of water, a compressed air pulse jet cleaning system is activated. The particulate drops from the bags to the bottom of the baghouse, where it is discharged through a rotary air lock equipped with six-inch diameter pipe which empties into a sealed container. The bottom of the baghouse module has sloped sides and electric vibrators to facilitate the discharge of collected particulate matter. Each baghouse module is equipped with heaters to maintain internal baghouse temperature above the dewpoint.

BRA PAS Exhaust Blower

The BRA PAS Exhaust Blower produces the motive force to induce the gas stream from the Drum Dryers and Evaporators into the atmosphere. The induced draft fan takes a suction from the BRA PAS, which then draws steam from the Drum Dryers and Evaporators located in the Brine Reduction Area. A variable pressure control damper located upstream of the induced draft fan controls the pressure in the BRA PAS. The BRA PAS is maintained at a negative pressure in relationship to atmospheric pressure.

BRA PAS Stack

Gases are discharged through the exhaust stack that is 65 feet high and 54 inches in diameter at the exit point.

INFORMATION SHEET 6-1-1 (Continued)
BRINE REDUCTION AREA

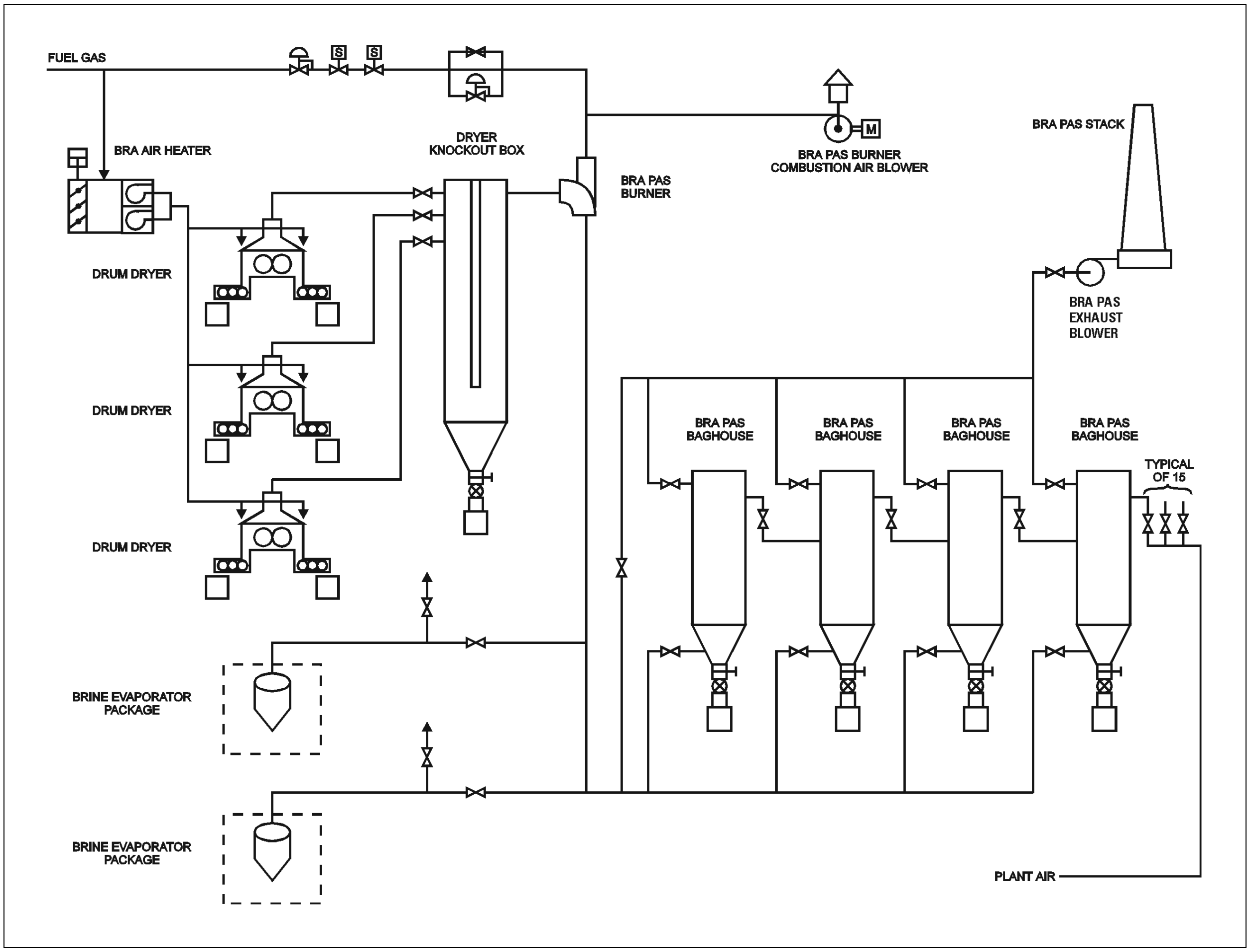

Figure 6-6: Brine Reduction Area Pollution Abatement System

OUTLINE SHEET 6-2-1
RESIDUE HANDLING AREA

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 6-2-1 “Residue Handling Area”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the Residue Handling Area.

   1.1 **IDENTIFY** the purpose of the Residue Handling Area.

   1.2 **IDENTIFY** the purpose of the 90-day storage area.

C. OUTLINE OF LESSON CONTENT

1. System Overview

   a. Process Description

      (1) Satellite Accumulation Areas

         (a) DFS Waste

         (b) DFS Cyclone Separator

         (c) MPF Waste

         (e) BRA Waste

      (2) Waste Bins

      (3) RHA Tilter

      (4) 90 Day Storage Area

INFORMATION SHEET 6-2-1
RESIDUE HANDLING AREA

A. INTRODUCTION

This sheet provides information on the handling of the waste products from various points throughout the demilitarization process.

B. REFERENCES

1. TOCDF Functional Analysis Workbook

C. INFORMATION

1. SYSTEM OVERVIEW

The Residue Handling Area (RHA) receives solid plant waste generated during process operations. The purpose of the RHA is to provide the equipment required to properly handle and contain the waste for temporary storage and shipment off-site. Figures 6-7 and 6-8 show the Residue Handling Area.

The waste is sent to a hazardous waste Treatment, Storage, and Disposal Facility designed to handle the types of process residue generated by the facility. Solid waste is discharged from the plant in the following areas:

- Deactivation Furnace (DFS)
- DFS Cyclone Separator
- Metal Parts Furnace (MPF)
- Brine Reduction Area
- BRA PAS
- BRA Knockout Box
- RHA Baghouse

INFORMATION SHEET 6-2-1 (Continued)
RESIDUE HANDLING AREA

PROCESS DESCRIPTION

Process related wastes are collected into waste bins, containerized in the Residue Handling area, and temporarily stored at the 90 Day Storage Area for eventual shipment to a hazardous waste Treatment, Storage, and Disposal Facility.

DFS Waste - Residue from the DFS consists of char from sheared rocket casings with fiberglass residue, mine casings, and incinerated scrap from the miscellaneous explosive components removed from munitions during demilitarization operations. Char is collected at the discharge end of the DFS in a waste bin and later containerized in the RHA.

DFS Cyclone Separator - The DFS Cyclone Separator is used to remove fiberglass from the flue gas exiting the DFS. Fiberglass is contained in the reinforced rocket shipping containers which are incinerated in the DFS. Fiberglass waste is collected in a waste bin at the discharge of the DFS Cyclone Separator and transported to the Metal Parts Furnace (MPF) for incineration. After the residue is incinerated in the MPF, the waste is taken to the RHA where the residue is properly contained for eventual disposal at a hazardous waste Treatment, Storage, and Disposal Facility.

MPF Waste - The MPF is used for the thermal decontamination of metal from demilitarization processing. The metal char is discharged to conveyors at the discharge end of the MPF. The metals are allowed to cool and are mutilated before being placed into a Roll Off Container for shipping to the 90 Day Storage Area and then to a Treatment, Storage, and Disposal Facility.

BRA Waste - As a result of brine reduction operations, salts are discharged from the Brine Reduction System. Salts are temporarily contained in salt waste bins and containerized in the RHA for eventual disposal.

INFORMATION SHEET 6-2-1 (Continued)
RESIDUE HANDLING AREA

Waste Bins

Waste is collected from the furnaces through the use of "Waste Bins." The bins provide a temporary means to collect and contain the waste until it can be properly contained for disposal.

RHA Tilter

The RHA Tilter provides a means of dumping full Waste Bins into Roll Off Containers. This process must contain all fugitive emission limits set forth in environmental regulations. The Waste Bins are transferred from the collection points and loaded into the tilter via forklift. The Waste Bins are then sealed and inverted by the tilter. The contents of the Waste Bins are transferred into the Roll Off Containers. All fugitive emissions/dust that is generated during the dumping process is collected by a dust collection system which is an integral part of the RHA Tilter. As the Roll Off Containers are filled, they are picked up by transport trucks and delivered to the 90 Day Storage Area or to a permitted storage area.

Satellite Accumulation Areas

The collection areas discussed below are termed "Satellite Accumulation Areas." Satellite accumulation area practices refer to the management of hazardous waste at or near the point of generation prior to transfer to a 90 Day Storage Area or permitted storage area. Containers that are used at satellite accumulation areas must be labeled as "Hazardous Waste." The containers shall also be covered and sealed to minimize spills. There is no storage time limit at the satellite accumulation area. The volume of waste is limited to a maximum of 55 gallons, or to one quart if waste is acutely toxic waste.

90 Day Storage Area

A 90 Day Storage Area is an area where hazardous waste may be stored for up to 90 days while arranging for off-site disposal. This transfer point allows for accumulating and storing the waste so that transfer to the permitted storage area can be scheduled.

INFORMATION SHEET 6-2-1 (Continued)
RESIDUE HANDLING AREA

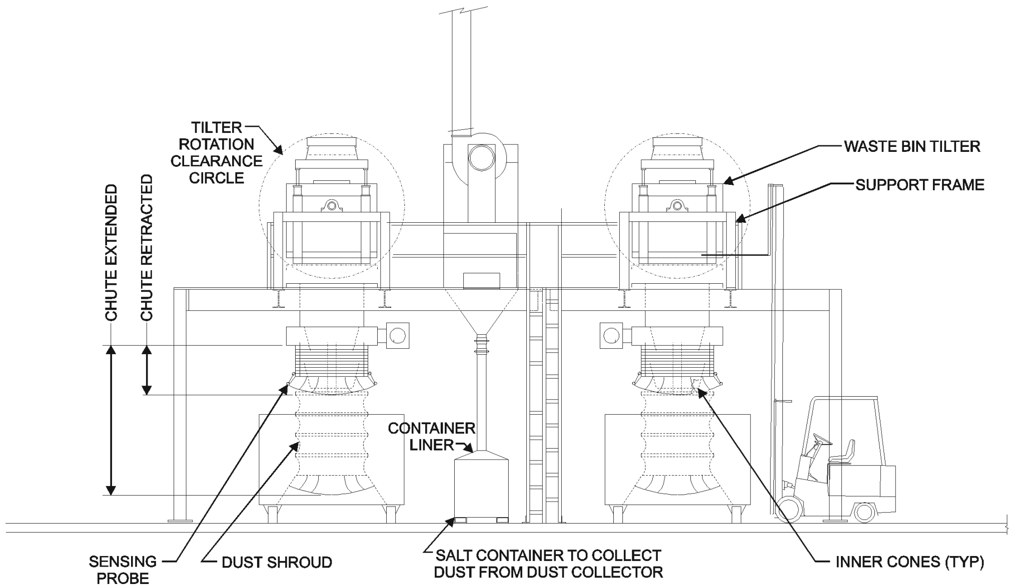

Figure 6-7: Residue Handling Area (Front View)

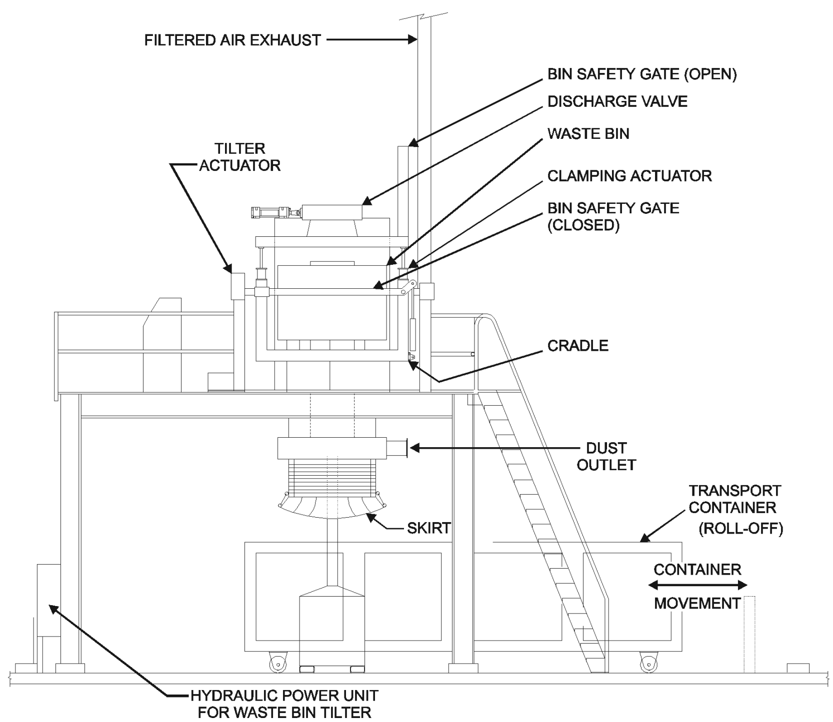

Figure 6-8: Residue Handling Area (Side View)

UNIT 7: LABORATORY

OUTLINE SHEET 7-1-1
LABORATORY MONITORING

A. INTRODUCTION

This sheet provides a content outline of Information Sheet 7-1-1 “Laboratory Monitoring”.

B. LESSON OBJECTIVES

1. **DESCRIBE** the agent and non-agent monitoring performed at a Chemical Agent Disposal Facility.

   1.1 **IDENTIFY** the purpose of air monitoring.

   1.2 **LIST** the six general locations where agent monitoring is performed.

   1.3 **IDENTIFY** the primary purpose of the Automatic Continuous Air Monitoring System (ACAMS).

   1.4 **IDENTIFY** the uses of the Depot Area Air Monitoring System (DAAMS).

   1.5 **IDENTIFY** the pollutants monitored for by the Continuous Emission Monitors.

C. OUTLINE OF LESSON CONTENT

1. Monitoring Concept

   a. Purpose

   b. Objective of Monitoring

      (1) Air Monitoring

      (2) Liquid and Solid Monitoring

   c. Requirements

OUTLINE SHEET 7-1-1 (Continued)
LABORATORY MONITORING

2. Monitoring Locations

   a. Agent Monitoring

      (1) Criteria Used to Determine Monitor Locations

         (a) Risk of Exposure

         (b) Other Criteria

   b. Non-Agent Monitoring

3. Safety Standards

   a. Agent Monitoring Levels

      (1) Time Weighted Average

      (2) Immediately Dangerous to Life and Health

      (3) Gross Level Detector

      (4) Maximum Permissible Limit

      (5) General Population Limit

      (6) Allowable Stack Concentration

      (7) Waste Control Level

   b. Engineering Control Levels

4. Monitoring Equipment

   a. Automatic Continuous Air Monitoring System (ACAMS)

      (1) Theory of Operation

      (2) Primary Purpose

      (3) Use

OUTLINE SHEET 7-1-1 (Continued)
LABORATORY MONITORING

b. Depot Area Air Monitoring System (DAAMS)

(1) Theory of Operation

(2) Primary Use

(3) Other Uses

c. Continuous Emission Monitors

INFORMATION SHEET 7-1-1
LABORATORY MONITORING

A. INTRODUCTION

This sheet provides information related to agent monitoring, monitoring concepts, and monitoring plans.

B. REFERENCES

1. *Laboratory Quality Assurance Plan for the Chemical Stockpile Disposal Program*, rev.5. Aberdeen, Maryland: Program Manager for Chemical Demilitarization, 1997.

C. INFORMATION

1. MONITORING CONCEPT

PURPOSE

Monitoring is a timely collection and analysis of information to determine the state of a process or the environment. Information obtained from monitoring is used to ensure that disposal operations are being conducted properly and to detect any conditions that may cause a release of chemical agent. During upset conditions, monitoring data is used to:

- Initially alert the operators to the problem.
- Provide quantitative data to the decision makers for responding to and solving the problem.
- Predict any impacts (e.g., dispersion of agent from a major release, etc.) that might be anticipated from the release.
- Provide historical data.

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

OBJECTIVE OF MONITORING

The objectives of monitoring during chemical munitions disposal are to:

- Provide adequate worker protection.
- Verify proper plant operating conditions.
- Ensure that all process emissions are kept in compliance with all applicable procedures and regulations.

To accomplish these goals, the monitoring systems must be properly located and configured. This ensures accuracy when monitoring levels of the chemical agents that may be present in the air and to ensure that emissions of industrial pollutants (e.g., NO_x, CO, etc.) do not exceed regulatory limits.

Air Monitoring

Air monitoring in the chemical agent disposal facility is performed for two purposes:

- Verifying that the demilitarization process control equipment is operating properly and concentrations of airborne chemical agents do not exceed safety standards (thereby protecting the worker)

- Ensuring that the plant emissions meet regulatory requirements (thereby protecting the environment).

Liquid and Solid Monitoring

Liquid and solid monitoring (i.e., sampling and analysis) are performed to ensure that liquid and solid wastes leaving the facility do not contain quantities of chemical agents exceeding safety standards. Liquid and solid wastes must also be characterized and any hazardous constituents identified for further treatment and/or disposal.

REQUIREMENTS

Specified agent monitoring equipment must be functioning properly in order for the plant to process. If critical equipment malfunctions or goes off line, operations are stopped until the monitors are repaired or replaced.

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

2. MONITORING LOCATIONS

AGENT MONITORING

Chemical agent disposal facility personnel are required to monitor for the chemical agents GB, HD, and VX in the following general locations:

- Inside the plant
- At the site perimeter
- Emissions from the pollution abatement system (PAS)
- Breathing air from the life support air system (LSS)
- Liquid wastes from plant processes
- Solid wastes from plant processes

Criteria Used to Determine Monitor Locations

Risk of Exposure - Several criteria are used to determine monitor locations. Foremost of these is the risk of exposure. The risk of exposure at any location is dependent upon the following conditions:

- The probability that agent will be present at concentrations in excess of established limits.

- The nature of the source agent (e.g., continuous or intermittent, frequent source versus an infrequent source).

- The probability that people are present in the area.

Other Criteria - Other criteria that are considered include:

- Level of protective clothing worn by workers in the area
- Physical configuration of adjacent areas
- Sensitivity and response time of the monitor
- Characteristics of the particular agent of concern

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

NON-AGENT MONITORING

Chemical agent disposal facility personnel also monitor for pollutants and by-products of the incineration process (i.e., "non-agent" monitoring), such as nitric oxides (NO_x), carbon monoxide (CO), carbon dioxide(CO_2), moisture, and phosphoric acid (H_3PO_4).

Carbon dioxide, oxygen, and carbon monoxide levels give plant operators a good indication of the combustion efficiency and over-all performance of the furnaces. All of these constituents are monitored during the trial burns, and only NO_x, CO, CO_2, and O_2 continue to be monitored throughout operations.

CO and NO_x are monitored to specifically meet the requirements of Toxic Substances Control Act (TSCA), and NO_x is monitored to meet the requirements of the Clean Air Act. The Resource Conservation and Recovery Act (RCRA) permit for each plant outlines the monitoring requirements and permissible levels of emissions.

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

3. SAFETY STANDARDS

AGENT MONITORING LEVELS

Safety standards for agent concentrations in various locations have been established by the Department of Defense (DoD) and in some cases by the U.S. Army Program Manager for Chemical Demilitarization. Seven agent monitoring levels are used at U.S. chemical agent disposal facilities:

- Time-weighted Average (TWA)
- Immediately Dangerous to Life and Health (IDLH)
- Maximum Permissible Limit (MPL) for use of the demilitarization protective ensemble
- Gross Level Detector (GLD)
- General Population Limit (GPL)
- Allowable Stack Concentration (ASC)
- Waste Control Limit (WCL)

Time Weighted Average - The Time Weighted Average is the airborne concentration to which unprotected workers may be repeatedly exposed for eight hours per day, five days per week, for a working lifetime without adverse health effects. The TWA is also used to indicate that a given item has been surface decontaminated (3X) by locally approved procedures and that monitoring results have shown agent vapor concentration is below one TWA.

Immediately Dangerous to Life and Health - The Immediately Dangerous to Life and Health level designates the maximum concentration from which one could escape within 30 minutes without a respirator and without experiencing any escape-impairing (e.g., severe eye irritation) or irreversible health effects, in the event of respirator failure. These values are intended for the purpose of respirator selection (i.e., the requirement for wearing of self-contained breathing apparatus or supplied air respirator protective devices).

Gross Level Detector - The Gross Level Detector is an engineering control level for mustard that has been established for exiting airlocks and specified locations within agent-contaminated areas. The level assigned is 0.2 mg/m^3. This level is consistent with the capabilities of the monitoring equipment and is below 1.67 mg/m^3, which correlates to the regulatory basis for IDLH level values for other agents. An IDLH level has not been assigned by regulation to mustard because of its carcinogenic properties.

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

Maximum Permissible Limit - The Maximum Permissible Limit for demilitarization protective ensemble is an engineering control level based on the maximum concentration in which personnel in demilitarization protective ensemble may work for two or less hours per entry in agent contaminated areas. The agent concentration and time limit on demilitarization protective ensemble entries at this engineering control limit was based on the maximum agent concentration used in demilitarization protective ensemble penetration testing.

General Population Limit - The General Population Limit is the allowable 72-hour time-weighted average concentration for indefinite unprotected exposure (i.e., 24 hours per day, 7 days per week for a 70 year lifetime) of the general public without adverse health effects.

Allowable Stack Concentration - The Allowable Stack Concentration is a ceiling value that serves as a source emission limit, not as a health standard. The ASC gives an early indication of an upset condition and must be accurately measurable in a timely manner by a well-designed, well-constructed, and well-operated incinerator facility. Modeling of worst-case credible events and conditions at each installation must confirm that the general population limit (GPL) monitoring level is not exceeded at the installation boundary as a consequence of releases at or below the ASC.

Waste Control Limit - The Waste Control Limit refers to a control standard for monitoring wastes.

The agent concentration levels used in U.S. chemical agent disposal facilities are shown in Table 7-1.

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

Table 7-1: Agent Monitoring Levels

Concentration, mg/m^3			
Standard	**GB**	**VX**	**HD**
TWA[1]	0.0001	0.00001	0.003
GPL	0.000003	0.000003	0.0001
ASC[2]	0.0003	0.0003	0.03
MPL[3]	100.0	---[4]	100.0
IDLH[5]	0.2	0.02	---
GLD[3]	---	---	0.2
WCL[6,7]	20.0	20.0	200.0

Footnotes:
1. Engineering control level for ventilation filter monitoring for HD and the life support air system for GB, VX and HD; also used during agent changeover operations.
2. Engineering control level for ventilation filter monitoring for GB and VX.
3. Engineering control level.
4. Due to the low vapor pressure of VX, the MPL of 100.0 mg/m3 has been replaced with the IDLH.
5. Engineering control level for monitoring of airlocks for GB and VX.
6. Engineering control level for wastes (liquid and solid).
7. Units are in micrograms per liter for a one milliliter or one gram sample.

ENGINEERING CONTROL LEVELS

Engineering control levels (ECLs) have also been created for chemical agent disposal facility operations. Two such engineering control limits are the gross level detector (GLD) and the maximum permissible limit (MPL) for the use of the demilitarization protective ensemble.

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

4. MONITORING EQUIPMENT

Chemical Agent Disposal Facilities use two types of monitors to sample the air for the presence of chemical agents. The primary monitor is the Automatic Continuous Air Monitoring System (ACAMS) and the secondary (or confirmation) monitor is the Depot Area Air Monitoring System (DAAMS). Dedicated continuous emissions monitors sample the pollution abatement system stacks for industrial pollutants.

AUTOMATIC CONTINUOUS AIR MONITORING SYSTEM (ACAMS)

Theory of Operation

The ACAMS is a modified gas chromatograph, which uses a flame photometric detector to detect and quantify sulfur- or phosphorus-containing compounds (i.e., agents). Figure 7-1 shows the front panel of an ACAMS.

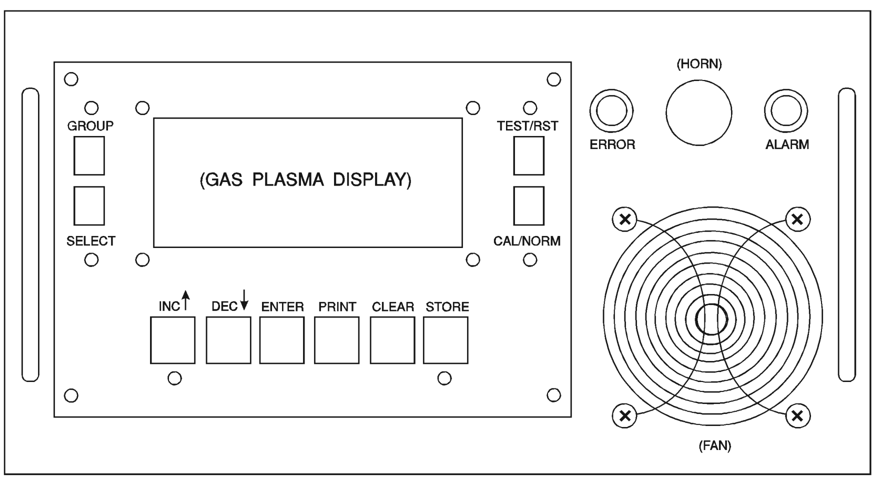

Figure 7-1: ACAMS Front Panel

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

Primary Purpose

The primary purpose of the ACAMS is to warn personnel by initiating an audible and visible alarm if the monitored air exceeds the applicable hazard level. The ACAMS is considered a "near-real-time" analyzer designed to detect and report high or low concentrations of chemical agents depending on the mode of operation.

Use

The ACAMS is programmed to alarm if the agent concentration exceeds the monitoring level (i.e., TWA, IDLH), indicating a spill or other type of inadvertent release of chemical agent. When the ACAMS is used to monitor the air in areas within the munitions processing plant, it is configured to operate in one of three monitoring levels. The monitoring levels are determined based upon the expected agent concentration in the area of the plant that the ACAMS monitors. The three levels are designated as:

- "Very High Level ACAMS" (MPL)
- "High Level ACAMS" (IDLH)
- "Low Level ACAMS" (TWA)
- "Low Level ACAMS" (ASC)

DEPOT AREA AIR MONITORING SYSTEM (DAAMS)

Theory of Operation

The DAAMS sample station samples the air for the presence of GB, HD, or VX in and around the chemical agent disposal facility. The DAAMS sample station uses 8 mm OD sample tubes, containing a solid sorbent material, through which sample air is drawn. Agent present is absorbed onto the sorbent material and is subsequently analyzed by the laboratory using a DAAMS-modified gas chromatograph.

Primary Use

The DAAMS station is primarily used to confirm (or refute) the presence of chemical agent following an ACAMS alarm. In this application, the DAAMS sample station is co-located with an associated ACAMS station (referred to as an "ACAMS-DAAMS station") and samples the same area or process as the corresponding ACAMS.

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

Other Uses

The DAAMS sample station is also used to provide a historical record in locations that are not analyzed by an ACAMS. These DAAMS sample stations are called historical samplers because they provide data that is used to draft permanent records in which to document that no agent was present in the monitored air on a specific day, at a specific time, and at a specific location in and around the plant. When used in this capacity the DAAMS sample stations are referred to as "stand-alone" or DAAMS-only stations. Stand alone DAAMS stations are mainly used at locations around the site perimeter, but are also used for monitoring the Life Support Air System, the Entry Control Facility (ECF), and other areas not monitored by the ACAMS. Figure 7-2 shows a DAAMS sample station.

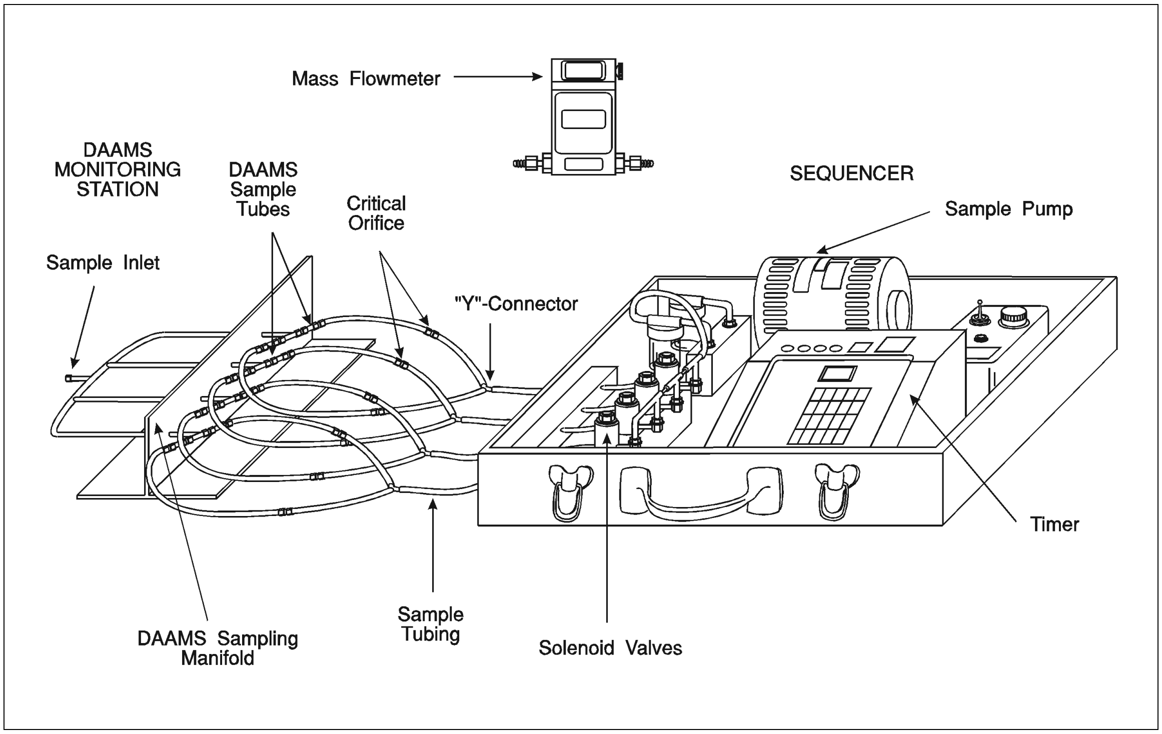

Figure 7-2: DAAMS Sample Station

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

CONTINUOUS EMISSION MONITORS

Continuous emission monitors (CEMS) are instruments that monitor the stack gases. The CEMS will monitor and analyze the stack gases for the following:

- Nitrogen Oxides
- Carbon Monoxide
- Carbon Dioxide
- Oxygen
- % Moisture

A separate monitor is used for each different industrial pollutant monitored. The Resource and Recovery Act (RCRA) permit for each individual plant outlines the permissible levels and exact location of the monitors for each and every pollutant monitored by the CEMS. See Figure 7-3

INFORMATION SHEET 7-1-1 (Continued)
LABORATORY MONITORING

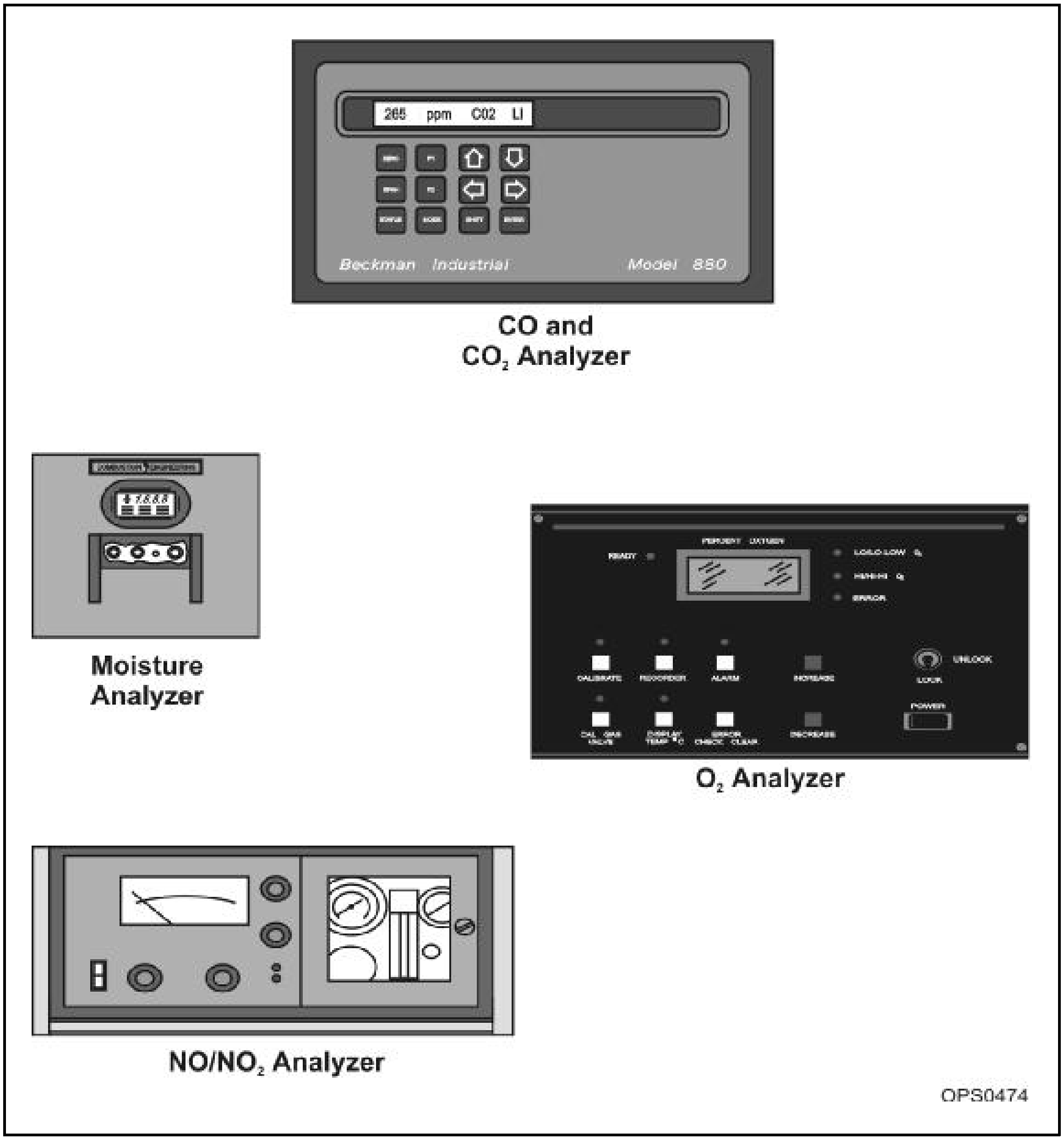

Figure 7-3: Continuous Emissions Monitors

APPENDIX A
ACRONYMS AND ABBREVIATIONS

ACAMS	Automatic Continuous Air Monitoring System
ACS	Agent Collection System
AHU	Air Handling Unit
AQS	Agent Quantification System
ASC	Allowable Stack Concentration
AWFCO	Automatic Waste Feed Cutoff
BDS	Bulk Drain Station
BFW	Boiler Feed Water
BLAD	Blast Attenuation Duct
BLOW	Blower
BMS	Burner Management System
BOIL	Boiler
BRA	Brine Reduction Area
BRS	Burster Removal Station
BSA	Buffer Storage Area
BSR	Burster Size Reduction Machine
BTU	British Thermal Unit
CAB	Combustion Air Blower
CAL	Chemical Assessment Laboratory
CAS	Compressed Air System
CCTV	Closed Circuit Television
CDF	Chemical Agent Disposal Facility
CDS	Central Decon System
CEMS	Continuous Emission Monitoring System
CFS	Chemical Feed System
CHB	Container Handling Building
CHRC	Charge Car
CNVM, CNVX, CNVP	Conveyor
CO	Carbon Monoxide
COMP	Compressor
CON	Control Room
COND	Condenser
CBR	Chemical, Biological, and Radiological
CRO	Control Room Operator
CSDP	Chemical Stockpile Disposal Program
DAAMS	Depot Area Air Monitoring System
Demil	Demilitarization
DFS	Deactivation Furnace
DoD	Department of Defense
DP	Differential Pressure
DPE	Demilitarization Protective Ensemble
DSA	DPE Support Area

APPENDIX A (Continued)
ACRONYMS AND ABBREVIATIONS

DUN	Dunnage Furnace
E&M Room	Engineering and Maintenance Room
ECF	Entrance Control Facility
ECR	Explosive Containment Room
ECV	Explosive Containment Vestibule
EDG	Emergency Diesel Generator
EHM	Equipment Hydraulic Module
EPA	Environmental Protection Agency
ETL	Extreme Temperature Limit
EVAP	Evaporator
EXPT	Expansion Tank
FAN	Fan
FEM	Fire Extinguishing Medium
FILT	Filter Unit
FSSS	Flame Safety Shutdown System
GB	Nerve Agent
GCS	Gimbal Cam Socket
GLD	Gross Level Detector
GPL	General Population Limit
H	Mustard/Blister Agent
HCL	Hydrochloric Acid
HD	Distilled Mustard
HEPA	High Efficiency Particulate Air
HF	Hydrofluoric Acid
HPC	High Pressure Condensate
HT	Mustard Agent with Sulfur and Chlorine
HVAC or HVC	Heating, Ventilation & Air Conditioning
HVB	High Velocity Burner
HYPC	Hydraulic Power Unit
IAS	Instrument Air System
ID	Induced Draft
IDLH	Immediately Dangerous to Life and Health
IDS	Intruder Detection System
JPM	Job Performance Measure
LAB	Laboratory
LIC	Liquid Incinerator
LPG	Liquid Petroleum Gas
LSS	Life Support Air System
LVB	Low Velocity Burner
MCCs	Motor Control Centers
MDB	Munitions Demilitarization Building
MDM	Multi-Purpose Demilitarization Machine

APPENDIX A (Continued)
ACRONYMS AND ABBREVIATIONS

MER	Mechanical Equipment Room
MIN	Mine Machine
MMB	Medical and Maintenance Building
MMS	Multi-Munitions Handling System
MPB	Munitions Processing Bay
MPF	Metal Parts Furnace
MPL	Multi-Position Loader
MPRS	Miscellaneous Parts Removal Station
MSB	Monitor Support Building
NaOCl	Sodium Hypochlorite
NaOH	Sodium Hydroxide
NCL	Sodium Hypochlorite System
NCRS	Nose Closure Removal Station
ONC	Onsite Container
PA	Plant Air System
PAS	Pollution Abatement System
PC	Advisor Personal Computor
PCS	Primary Cooling System
PDAR	Process Data Acquisition Recording
PHS	Projectile Handling System
PKPL	Pick and Place Loader or Machine
PLC	Programmable Logic Controller
PMB	Personnel and Maintenance Building
PMD	Projectile/Mortar Disassembly Machine
PPS	Primary Power Supply
PRW	Process Water
PSB	Process Support Building
PSC	Personnel Support Complex
PUB	Process and Utilities Building
PUMP	Pump
PV	Process Variable
RCRA	Resource Conservation and Recovery Act
RDS	Rocket Drain Station
REVC	Reject
RF	Radio Frequency
RHA	Residue Handling Area
RHS	Rocket Handling System
RSM	Rocket Shear Machine
RSS	Rocket Shear Station
SCBA	Self Contained Breathing Apparatus
SCW	Secondary Cooling Water
SD	Spent Decon

APPENDIX A (Continued)
ACRONYMS AND ABBREVIATIONS

SDS	Spent Decon System
SDSF	Spent Decon Storage & Feed
SGS	Steam Generating System
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SPS	Secondary Power System
SRS	Slag Removal System
SWGR	Switchgear
TMA	Toxic Maintenance Area
TOCDF	Tooele Chemical Agent Disposal Facility
TOX	Toxic Cubicle
TSCA	Toxic Substances Control Act
TWA	Time Weighted Averages
UPA	Unpack Area
UPS	Uninterruptible Power Supply
UV	Ultraviolet
VAC	Volts Alternating Current
VEST	Vestibule
VX	Nerve Agent
WCL	Waste Control Limit
WTS	Water Treatment System